PESTICIDES ABSTRACTS

December 1979 - Vol. 12, No. 12
Abstracts 79-2851-3150
PSTAB 12(12):723-783 (1979)

U.S. ENVIRONMENTAL PROTECTION AGENCY

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
CHEMICAL INFORMATION DIVISION
Rm. E447, 401 M Street, S.W.
Washington, D.C. 20460

PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Office of Pesticide Programs, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

Publication of an abstract, annotation, or citation does not imply endorsement by the Environmental Protection Agency of the original article or of commercial materials, equipment, or processes mentioned therein.

Volume 12 December 1979 No. 12

Page

General 723
(News items, letters, and editorials appearing in scientific and technical journals; information on production and use; and other items of general interest)

Monitoring and Residues 733
(levels of pesticides in people or nonexperimental animals or in water, air, soil, food, feed, and other consumer products)

Epidemiology, Prevention and Treatment 744
(Frequency and distribution of pesticide poisoning in man or nonexperimental animals and treatment of clinical cases; morbidity and mortality; safety measures; decontamination; disposal of containers and wastes; legislation and regulations)

Toxicology and Pharmacology 749
(Toxicity studies in man and animals; effects on cells; organs, and systems; metabolic studies, biochemistry, interactions; antidotes and other treatment; mode of action. Ordinarily, articles dealing with efficacy studies are not included.)

Analysis 773
(preparation of samples; analytical methods; instrumentation)

79-2851. Khan, M. A. Q., ed.; Lech, J. J., ed.; Menn, J. J., ed. (Univ. Illinois, Chicago, IL 60680) **Pesticide and xenobiotic metabolism in aquatic organisms.** *ACS Symp. Ser.* 99: 436 p.; 1979.

Proceedings of this symposium, which is international in scope, deal with the metabolism and disposition of pesticides and other xenobiotic substances in aquatic organisms. Both in *in vivo* and *in vitro* metabolism of a wide variety of chemicals in aquatic organisms are presented. The book is divided into two sections, the first dealing with the *in vivo* metabolism of chemicals in aquatic organisms and the second with the mechanisms of metabolism and disposition of xenobiotic chemicals in these species. An index is also included at the end of the book.

79-2852. Rappe, C.; Buser, H. R.; Bosshardt, H. P. (Dep. Org. Chem., Univ. Umea, S-90187 Umea, Sweden) **Dioxins, dibenzofurans and other polyhalogenated aromatics: production, use, formation, and destruction.** *Ann. NY Acad. Sci.* 320:1-18; 1979 (39 references).

Production, use, formation, and destruction of the polyhalogenated benzenes and toluenes, biphenyls, terphenyls, naphthalenes, chlorinated phenols, phenoxy acids, and diphenyl ethers are reviewed. Chlorophenols are useful as fungicides, herbicides, and slimacides as well as bactericides. They are also functional as key intermediates in the production of the chlorinated acids 2,4-D, 2,4,5-T and MCPA. The exposure and subsequent risks from these chemicals are noted.

79-2853. Hay, A. (Dep. Anim. Physiol. & Nutr., Univ. Leeds, Leeds LS5 3HL, England) **Accidents in trichlorophenol plants: a need for realistic surveys to ascertain risks to health.** *Ann. NY Acad. Sci.* 320: 321-324; 1979.

Data collected from the Seveso accident are reviewed. The need for controlling the open-ended approach in gathering this type of information and for reaching conclusions based on such information are suggested. It is urged that workers who have been exposed to dioxins in the manufacture of trichlorophenol, a precursor to the phenoxyacid herbicides, be monitored as a group, so that data important to the risk assessment of TCDD can be more methodically collected. The need for objective assessment of TCDD exposure by relating clinical symptoms and biochemical findings to dioxin/TCDD residues in the body is stressed.

79-2854. Lombardo, P. (Div. Chem. Technol., US FDA, Washington, DC 20204) **FDA's chemical contaminants program: the search for the unrecognized pollutant.** *Ann. NY Acad. Sci.* 320: 673-677; 1979.

The Chemical Contaminants Program started by the US FDA in 1971 for developing sufficient information to establish guidelines for recognized industrial chemical contaminants of food, anticipating and searching for contaminants which were as yet unrecognized, evaluating the hazards if these were found in foods, and taking steps to eliminate or minimize the problems thus created is discussed. The findings by the program on specific chemicals are reported. These include chlorinated benzenes, chlorinated benzyl chlorides and benzotrifluorides, chloronitrobenzenes, pentachloroaniline, pentachlorophenyl methyl sulfide, chlorinated cycloaliphatics, chlorinated aliphatics, brominated aromatics, phosphates, and aromatic amines.

79-2855. DeCarlo, V. J. (Off. Toxic Subst., US EPA, Washington, DC 20460) **Studies on brominated chemicals in the environment.** *Ann. NY Acad. Sci.* 320: 678-681; 1979 (3 references).

Monitoring studies were conducted in El Dorado and Magnolia, Arkansas, to detect brominated chemicals resulting from manufacturing processes in these areas. In all, 26 brominated organics were detected in the air, water, soil, sediment, and front and tail brine, or human hair. The specific compounds detected and the substances in which they were found are listed.

79-2856. Calabrese, E. J.; Tuthill, R. W.; Sieger, T. L.; Klar, J. M. (Univ. Massachusetts, Amherst, MA 01003) **Lead and cadmium contamination during acid preservation of water samples.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 107-111; 1979 (1 reference).

Two studies were conducted in which water samples from high and low sodium content areas were tested for lead and cadmium. In one test, acidification was by pipetting acid into the samples. In the other test, acid was added by breaking a pre-measured glass ampule into the sample. The test in which glass ampules were used revealed a much higher lead content in both the high and low sodium areas than was observed in the test in which acid was pipetted. For the high sodium area, the lead was 4.6 and 19 ppb for the two tests, and for the low sodium area the lead was 11 and 64 ppb for the two tests. Similar increases were seen for cadmium. However, there had been no change in the drinking water source between the time of the two tests. It was discovered that a blue line painted on the ampules was the source of the heavy metal contamination.

79-2857. Meier, E. P.; Dennis, W. H.; Rosencrance, A. B.; Randall, W. F.; Cooper, W. J.; Warner, M. C. (Med. Bioeng. Res. & Dev. Lab., US Army, Fort Detrick, Frederick, MD 21701) **Sulfotepp, a toxic impurity in for-**

mulations of diazinon. *Bull. Environ. Contam. Toxicol.* 23(1-2): 158-164; 1979 (11 references).

In studies to determine methods for chemical degradation and disposal of pesticide wastes, a residual toxicity was noted. Four potential causes were indentified: formulation of inert toxic ingredients, unidentified toxic products, synergistic toxicity of two or more ingredients, or unidentified toxic impurities. Careful analysis of the pesticide (diazinon) reaction mixtures led to the identification of the chemical species responsible for the toxicity. Sulfotepp was identified as an impurity in all of the diazinon formulations studied. Concentrations ranged from 1.4 ppm to 6.9 ppm. Potential sources of contamination are reviewed, as are the toxicity and the implications of the findings presented in this report.

79-2858. Sterner, R. T. (US Fish & Wildl. Serv., Denver Wildl. Res. Cent., Denver, CO) **Effects of sodium cyanide and diphacinone in coyotes (*Canis latrans*): applications as predacides in livestock toxic collars.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 211-217; 1979 (12 references).

Wild coyotes were tested in acute oral toxicity tests and toxic-collar tests using the compounds sodium cyanide (NaCN) and diphacinone. Five coyotes received 4, 8, 16, 32, or 64 mg/kg of NaCN by oral syringe in the acute toxicity test. Five other coyotes were similarly given diphacinone at 0.3, 1.2, 2.4, 4.8, or 9.6 mg/kg, and venous blood samples were taken from each animal at 1 hr before dosing and at 72 and 144 hr after dosing to determine the residues of the pesticide. Other blood samples were taken 1 hr before and 48, 96, 144, 216, 288, 360, and 408 hr after dosing to analyze for prothrombin clotting time. Results of the NaCN acute oral toxicity test showed survival of the one coyote given 4 mg/kg of the pesticide. The other four animals died within 2 min after dosing. For diphacinone, the coyotes doses with 4.8 mg/kg or less survived whereas the coyote receiving 9.6 mg/kg died after 10 days. Residues for diphacinone in the coyotes ranged between 0.001 and 0.005 ppm for 72 hr and between 0.001 and 0.003 ppm for 144 hr from the time of dosing. Peak clotting times of the coyotes given sublethal doses of diphacinone were calculated at between 40-80 sec and occurred between 72 and 196 hr after dosing. The coyote dosed with 9.6 mg/kg diphacinone displayed an increased clotting time of 111 sec approximately 144 hr after dosing. In the toxic-collar experiments six coyotes were allowed to attack penned sheep fitted with collars containing either diphacinone or NaCN. Toxicity and behavioral measures examined included time spent mouthing the collar, time to immobilization, time to death, and chemical resides of NaCN in blood and esophagus-stomach, and diphacinone in blood. Only 1 of the coyotes that punctured an NaCN collar ingested a lethal dose of the poison, whereas 3 coyotes that punctured the diphacinone collars all received lethal amounts of the anticoagulant. The time of death and time to immobilization in the case of the NaCN-treated collars was much shorter than when the diphacinone-treated collars were used. Implications of these results in relation to toxic collar control of coyote predation upon grazing sheep are discussed.

79-2859. Cheevaparanapivat, V.; Menasveta, P. (Inst. Environ. Res., Chulalongkorn Univ., Bangkok, Thailand) **Total and organic mercury in marine fish of the upper Gulf of Thailand.** *Bull. Environ. Contam. Toxicol.* 23(3): 291-299; 1979 (14 references).

Fish samples were collected by otter trawl, and plankton was sampled by plankton net in September 1976 and March 1977 from the upper Gulf of Thailand. Total mercury was determined by flameless atomic absorption technique. Total mercury in plankton and fish ranged from 2 to 650 ppb with a mean value of 4 ppb. Organic mercury in plankton and fish ranged from 0 to 280 ppb with a mean of 23 ppb. Levels of less than 50 ppb (82% of the samples) were reported to be background. Two fish, one giant catfish and one malabar snapper, had levels that exceede the US FDA's tolerances of 500 ppb. It is suggested that no biological magnification of mercury occurs. Although the highest levels occurred in organisms at the highest trophic levels, it is believed that the mercury is concentrated in the same manner as organic compounds passing through, and being amplified by, the food chain.

79-2860. Parvaneh, V. (Dep. Food Hyg., Univ. Tehran, Tehran, Iran) **An investigation on the mercury contamination of Persian Gulf fish.** *Bull. Environ. Contam. Toxicol.* 23(3): 357-359; 1979 (12 references).

Tests were performed to investigate the levels of mercury contamination in fish of the Persian Gulf. Random samples of four important species, *Cybium comersonii, Cybium guttatum, Lutjanus coccineus,* and *Psettodes erimei,* as well as samples of canned tuna were collected. Flameless atomic absorption spectrophotometry was used for analysis. Ten specimens of *C. commersonii* were analyzed, resulting in mercury levels ranging from 0.07 to 0.56 mg/kg. Eight specimens of *C. guttatum* contained mercury levels ranging from 0.08 to 0.2 mg/kg. Eight specimens of *L. coccineus* contained mercury levels ranging from 0.08 to 0.48 mg/kg. Five specimens of *P. erimei* contained mercury levels ranging from 0.04 to 0.3 mg/kg. Eighteen cans of tuna contained 0.2-0.44 mg mercury/kg. Mercury contamination in the study area was found to be less than the 0.5 mg/kg allowed in most countries.

79-2861. Anonymous **Debate continues over Dow's dioxin theory.** *Chem. Eng. News* 57(39): 27-28; 1979.

Dow Chemical Company's theory that polychlorinated dibenzo-*p*-dioxins (such as TCDD), dibenzofurans, and biphenyls are formed in trace amounts during combustion processes is discussed. Dow contends that

almost anything that will burn can serve as a precursor to these compounds. If this theory is correct, then pesticides such as 2,4,5-T are perhaps much less important contributors of dangerous products like the carcinogenic and teratogenic TCDD than previously believed. Evidence contrary to, and in support of, Dow's contention is discussed.

79-2862. Anonymous **Sperm density tied to toxic substances level.** *Chem. Eng. News* 57(39): 34-35; 1979.

Correlations between lowered sperm densities in US males and the presence of polychlorinated bihenyls (PCB) with 5 to 8 chlorines have been found by a Florida State University researcher. The maximum in sperm density distribution in 1929 was 100 million/ml, compared with 60 million in 1974, and 20 million in the recent study. Differences in the sample populations, and sociological and behavioral differences among the study groups may account for some of the difference in sperm counts, but all of the seminal plasma samples examined at Florida State were contaminated with toxic substances. The most commonly occurring of these were PCB, HCB (hexachlorobenzene), and DDT metabolites.

79-2863. Anonymous **Approvals for pyrethrum substitutes stepped up.** *Chem. Eng. News* 57(40): 8; 1979.

The US EPA has conditionally registered several pyrethrum substitutes, pyrethrins, for the emergency control of flies in poultry and dairy barns. Because of the pyrethrum shortage, the pyrethrins may be used in about 100 insecticides pending the completion of studies on their long-term environmental and health effects. Among the conditionally approved pyrethrins are: permethrin, D-phenothrin, tetramethrin, resemthrin, and allethrin. Poultry farmers in four states may use permethrin, and all states may use allethrin in dairy barns to control flies. Another 150 pyrethrin-containing insecticides will be conditionally registered when manufacturers submit certain labeling and other required information. An additional 150 requests are still pending. By 1981, adequate supplies of pyrethrum are again expected to be available.

79-2864. van de Ven, W. S. M.; Koeman, J. H.*; Svenson, A. (Dep. Toxicol., Agric. Univ., NL-6703 Wageningen, The Netherlands) **Mercury and selenium in wild and experimental seals.** *Chemosphere* 8(8): 539-555; 1979 (47 references).

The possible involvement of selenium in the biotransformation and tissue distribution of methylmercury in seals was assessed, and additional data on the tissue distribution of mercury and selenium in wild seals were collected. Also, it was determined whether the feces of seals have any demethylating capacity. A time-related increase of both mercury and selenium was found in the liver and kidneys of experimental animals after the administration of methylmercury, while only mercury concentrations increased in other tissues examined. In experimental seals fed fish contaminated with methylmercury, selenium concentrations showed a positive correlation with mercury concentrations. In wild seals, the atomic ratios of mercury and selenium were close to 1; however, in seals fed additional methylmercury, atomic ratios above 1 were found. *In vitro* studies of seal liver homogenates did not indicate the presence of a biochemical demethylation mechanism or provide evidence for any effect of selenium on the demethylation process. Also, no indicating of demethylation of feces was found under aerobic or anaerobic conditions.

79-2865. Sandifer, S. H.; Trammel, H. L. (South Carolina Pestic. Epidemiol. Stud. Cent., Med. Univ. South Carolina, Charleston, SC 29403) **Letter to the editor.** *Clin. Toxicol.* 14(4): 459; 1979.

In this letter to the editor information is provided about the National Pesticide Telecommunication Network. The network provides consultation for the management and treatment of pesticide poisonings for the 48 contiguous states with 24 hr physician coverage. The Network is offered through the Medical University of South Carolina, and is funded by the US EPA.

79-2866. Ehrenberg, L. (Wallenberg Lab., Stockholm Univ., Stockholm, Sweden) **Risk assessment of ethylene oxide and other compounds.** *Cold Spring Harbor Symp. Ser., Banbury Rep.* 1:157-190; 1979.

The principles of risk assessment of mutagenic and carcinogenic compounds were illustrated using ethylene oxide as a model compound. First, the quantitative analysis of data is discussed. This analysis is done to make quantitative risk assessments for positive biological tests, to get a measure of the resolving power of biological tests, and to clarify the question of whether a negative test excludes a nonacceptable risk. The use of radiation risk as a standard in the evaluation of genetic risks of chemicals is then discussed. Dose response curves are presented for radiation and various chemicals. The problem of doses below which experimentation is impossible leads to lack of data or theory that sustains a general existance of safe thresholds of dose-response curves. The degree of alkylation, the mutagenic effectiveness of alkylating agents and dose levels appear to be positively related. It has been argued that some cancer tests with ethylene oxide have given false negative results. Preliminary data, however, indicate that ethylene oxide is carcinogenic in man, based on more recent studies on exposure to this alkylating agent. The author states that monitoring alkylation of hemoglobin is a means of identifying populations at risk. Using unit radiation risk as a standard, the reaction-kinetics may be applied to quantify the risk. It is believed that every compound that

is, or is converted to, an alkylating agent is mutagenic and most likely carcinogenic.

79-2867. Khan, S. U. (Chem. Biol. Res. Inst., Agric. Canada, Ottawa, Ontario, Canada) **The interaction of organic matter with pesticides.** *Dev. Soil Sci.* 8(Ch. 4): 137-171; 1978 (196 references).

This review of the interaction of soil organic matter with pesticides considers the following areas of interest: the nature of pesticides; mechanisms of adsorption; adsorption isotherms; adsorption of specific types of pesticides by organic matter, with attention given to ionic and nonionic pesticides; adsorption of pesticides by organic matter - clay complexes; techniques used in pesticide-organic matter interaction studies; chemical alteration and binding of pesticides. While much work has been done in these areas, the current knowledge of the fate of pesticides and their decomposition products has progressed only to the point that pesticides become immobilized in soil by chemical bonding to organic matter. Subsequent extraction is not yet possible.

79-2868. Done, A. K. (Author address not given) **Of metals and chelation.** *Emerg. Med.* 11(9): 186-189, 195, 201-203, 209, 213, 217-218; 1979.

The toxicological characteristics of many metals involved in poisonings showing various clinical courses are often very similar. A review of the minor metals, their sources, uses, and toxic effects is given, as well as common chelating agents that are used to minimize the effects of poisoning by each. Among the metals mentioned are arsenic, boron, copper, mercury, thallium, tin, vanadium, and zinc which are often found in formulations of insecticides, fungicides, herbicides, and rodenticides. The usefulness of edetate calcium disodium, dimercaprol, penicillamine or other substances for metal chelation in the event of poisoning is given in tabular form.

79-2869. Masner, P.; Trautmann, K. H.; Muehle, T. (Biol. Lab., CH-8157 Dielsdorf, Switzerland) **Effective dose present in cockroach larvae exposed continuously to a juvenile hormone active insect growth regulator.** *Experientia* 35(8): 1124-1126; 1979 (3 references).

Larvae of the German cockroach exposed to filter paper impregnated with juevnile hormone (JH) active substance contain, at the middle of the last instar, about one-hundredth of the dose applied to 1 cm^2. The amount of metabolized substance rises sharply before and disappears rapidly after the ecdysis into the supernumerary instar. (Author abstract by permission)

79-2870. Pandey, H. N.; Ram, V. J.; Mishra, L. (Dep. Chem., S.C. Coll., Ballia, India) **Heterocyclic thioureas as pesticides.** *Indian J. Exp. Biol.* 17(6): 614-615; 1979 (9 references).

Various thioureas were screened as pesticides with the result that the oxadizole nucleus appeared to have little or no effect on the pesticidal activity of the compounds. The aryl moiety present at position 3 in the thiourea molecule and at position 5 in the oxadiazole nucleus appeared to be the only structural feature which seemed responsible for bioresponses. As the basicity of aryl substituents attached at position 5 of the oxadiazole nucleus increased, the activity increased. In post-emergence tests, however, the activity does not follow this suggestion.

79-2871. Kas'ianenko, A. G.; Koroleva, N. S. (Dep. Gen. Genet. Cotton, Acad. Sci. Tadzhik SSR, Dushanbe, USSR) **Otsenka geneticheskoi opasnosti pestitsidov. [Evaluation of genetic danger of pesticides.]** *Izv. Akad. Nauk SSSR Ser. Biol.* (3): 401-409; 1979 (28 references) (Russian).

Current data on the genetic effect of a series of 160 pesticides are reviewed. The mutagenic properties were detected in 57% of tested fungicides, 63% of insecticides, 42% of herbicides. It is emphasized that the mutagenicity of pesticides should be tested in multicellular organisms, such as mice, rats, or *Drosophilia.* Currently, the cultures of human tissues are employed for *in vitro* evalution of mutagenic activity of various chemicals. Some pesticides have gonadotropic effects. Examination of different tissues of a common seagull showed that the level of DDT in the ovaries was 2.8 times greater than in the fat and 6.6 times greater than in the liver. The level of DDT in the testis was 4.4 times and 10 times greater than in the fat, and liver or muscles, respectively.

79-2872. Jurd, L.; Fye, R. L.; Morgan, J., Jr. (West. Res. Res. Cent., Sci. & Educ. Adm., USDA, Berkeley, CA 94710) **New types of insect chemosterilants. Benzylphenols and benzyl-1,3-benzodioxole derivatives as additives to housefly diet.** *J. Agric. Food Chem.* 27(5): 1007-1016; 1979 (28 references).

Benzyl and cinnamyl derivatives of 2,4-di- *tert*-butylphenol and of 1,3-benzodioxoles sterilize mixed sexes of houseflies when fed at concentrations as low as 0.025% in the diet. Several of the compounds are also active against males, the most effective male sterilants being 2,4-bis (1,1-dimethylethyl)- 6- [(4-methoxyphenyl) methyl] phenol (1c), 5-propoxy- 6-[(4-methoxyphenyl) methyl]- 1,3-benzodioxole (9d), and 5-ethoxy-6- [1- (4-methoxyphenyl) ethyl]- 1,3-benzodioxole (10c) at concentrations of 0.25, 0.1, and 0.05%, respectively. Benzyl- 2,5-di- *tert*-butylphenols are generally inactive. Structure-activity correlations suggest that sterilant activity is due to *in vivo* oxidation of the compounds to reactive quinone methides. The 1c and other benzylphenols are only slightly toxic to mice and is nonmutagenic in standard Ames bacterial tests.

(Author abstract reprinted by permission of the American Chemical Society)

79-2873. Schuphan, I.; Casida, J. E. (Pestic. Chem. & Toxicol. Lab., Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) ***S*-Chloroallyl thiocarbamate herbicides: chemical and biological formation and rearrangement of diallate and triallate sulfoxides.** *J. Agric. Food Chem.* 27(5): 1060-1067; 1979 (24 references).

S-Chloroallyl diisopropylthiocarbamate sulfoxides are obtained on treating the corresponding thiocarbamtes such as diallate and triallate herbicides with equimolar *m*-chloroperbenzoic acid in chloroform at -15°C and workup at low temperature. Within 10-120 min at 40°C, sulfoxides with 3-chloro-, *cis*- and *trans*- 2,3-dichloro-, and 2,3,3-trichloroallyl substituents undergo a [2,3] sigmatropic rearrangement, followed by a 1,2-elimination reaction to yield acrolein, 2-chloracrolein, and 2-chloroacrylyl chloride, respectively, plus diisopropyl carbumoyl sulfenyl chloride. The carbamoylsulfenyl chloride decomposes to diisopropyl carbamoyl chloride. These sulfoxides are also very reactive with glutathione, yielding *S*-diisopropyl carbamoylgl gutathione. Metabolism of the diallate isomers proceeds via their sulfoxides to form 2-chloroacrolein in the mouse hepatic microsomal oxidase system and 2,3-dichloro- 2-propene -1- sulfonic acid in mice and rats *in vivo* and their liver oxidase preparations. The herbicidal activities of diallate and triallate probably result from the metabolically formed sulfoxides acting as carbamoylating agents for criterical enzyme thiol groups or liberating chloroallyl-containing toxicants such as 2-chloroacrolein. (Author abstract reprinted by permission of the American Chemical Society)

79-2874. Doyle, J. J. (Sheep Exp. Stn., ARS, USDA, Dubois, ID 83423) **Toxic and essential elements in bone. A review.** *J. Anim. Sci.* 49(2): 482-497; 1979 (119 references).

A summary of levels of toxic elemental residues from pesticides, antibiotics and other chemicals as well as essential elements in bone is presented. Recent data on the concentration of arsenic, mercury, cadmium, lead, selenium, fluoride, calcium, phosphorous, magnesium, zinc, copper, iron and manganese in the bone of cattle, sheep, swine, and chicken is included. When available, the weight of the animal and th dietary concentration of the relevant element are also presented. The data are discussed in regard to contamination of mechanically deboned meat with toxic elements from bone.

79-2875. Yodaiken, R. E. (NIOSH, Rockville, MD) **Ethylene dibromide and disulfiram - a lethal combination.** *J. Am. Med. Assoc.* 239(26): 2783; 1979 (6 references).

Experiments have lead to concern over exposure of workers to ethylene dibromide who are receiving medical treatments containing disulfiram. A multitude of malignant tumors developed in experimental animals receiving disulfiram concurrently with exposure by inhalation to the permissible levels of ethylene dibromide. Adenocarcinomas of the mammary tissue appeared at an earlier age than had been expected. The reaction between drugs and environmental contaminants has not as yet received much attention, but problems such as the ones noted to here emphasize the need for such research.

79-2876. Gonzalez, E. R. (Author address not given) **Teratogen may be implicated in lethal congenital syndrome.** *J. Am. Med. Assoc.* 242(11): 1119-1120; 1979.

An unidentified teratogen has been implicated as the cause of birth defects in numerous cases reported from different geographical locations. Characteristic malformations observed included imperforate anus, renal agenesis or dysplasia, postaxial polydactyly, nail dysplasia, unusual facies, multiple frenule of the gums, laryngeal clefts, bifid or absent epiglottis, and other anomalies. The teratogenic effects eventually prove fatal to the affected neonates, and upon autopsy, an unusually large hamartoblastoma of the pituitary area is often uncovered. Although the causative agent is believed to be an environmental teratogen, herbicides and dioxin have not been blamed until further information is available. Exposure to pesticides occurred in some of the mothers of the deformed infants. The common solvent used in various compounds that the women inhaled is also not being ruled out as the possible harmful environmental agent.

79-2877. Anonymous **Diabetes, cyanide and rat poison.** *Lancet* 2(8138): 341-342; 1979 (18 references).

Tropical diabetes is discussed with specific interest in the forms in which patients are not prone to ketosis but demonstrate pancreatic calcification. The calcification in young diabetics is known in widely distributed parts of the world, including Zaire, Nigeria, Malawi, Uganda, Singapore, and the South Indian state of Kerala. The dietary ingredient suspected of being a pancreatic poison is cassava. It is believed that a cyanide-containing glycoside in the outer layer of the tuber is a potentially harmful ingredient of cassava. The bluish tint of lips in patients with diabetes accompanied by pancreatic calcification is evidence of the role of cyanide. Rats fed cyanide demonstrate temporary symptoms of diabetes. The authors relate these findings to the possibility of toxins playing a role in the etiology of some cases of diabetes. The action of the rodenticide *N*- 3-pyridyl methyl- *N*-*p*- nitrophenylurea on humans is the rapid onset of diabetes with a tendency to ketosis and severe autonomic neuropathy. The authors have, therefore, drawn similarities and possible correlations between cyanide and a rat poison in the etiology of diabetes.

79-2878. Jenkyn, L. R.; Budd, R. C.; Fein, S. H.; Cornell, C. J. (Sect. Neurol., Div. Hematol. Oncol., Dartmouth-Hitchcock Med. Cent., Hanover, NH 03755) **Insecticide/herbicide exposure, aplastic anemia, and pseudotumor cerebri.** *Lancet* 2(8138): 368; 1979 (9 references).

A case history was presented in which a 14-yr-old girl was referred for evaluation of pancytopenia. She had reported that 4 mo earlier she had suffered a bout of fatigue, headaches, nausea and vomiting. Bilateral pupilloedema and flame hemorrhages were noted on physical examination, but no adenopathy, organomegaly or focal neurological signs were observed. She had been repeatedly exposed to insecticides and herbicides while working in fields for 4 mo in 1976. She was exposed to zineb, ziram, malathion, carbaryl, naphthyl, and methylcarbamate. Laboratory findings were presented, the most remarkable being hypocellular bone marrow with predominance of plasma cells and lymphocytes, and demineralization of the dorsum sellae. The patient remained thrombocytopenic until death in May, 1977. Necropsy showed intracranial, subglossal, periorbital, and intraperitoneal hemorrhage. The development of pseudotumor cerebri may have been a result of the toxic effect on absorptive mechanisms of the CSF in the brain.

79-2879. AnonymousTreatment centres for paraquat poisoning. *Lancet* 2(8138): 375-376; 1979.

Because of the difficulty of confirming paraquat poisoning and promptly treating victims, a number of medical centers throughout the United Kingdom have developed a specialized treatment scheme. Doctors treating a case of suspected paraquat poisoing are invited to refer to the nearest center. Hemodialysis and/or hemoperfusion treatment would be available at these centers, all of which are listed.

79-2880. Sare, W. M. (14 Bank St., Te Awamutu, New Zealand) **2,4,5-T and the problems of toxicity.** *Med. J. Aust.* 1(11): 526; 1979 (1 reference).

In a letter to the editor, the problem of the possibility of teratogenicity and embryotoxicity to the human fetus resulting from exposure to 2,4-D and 2,4,5-T containing dioxin is readdressed. The occurrence of fetal toxicity in animal tests at dosage levels that produce maternal toxicity is cited as a special case that needs further examination before the compound in question is dismissed as non-teratogenic. It is also suggested that the extreme sensitivity of the human fetus to 2,4,5-T containing dioxin is a factor that has been overlooked in fetotoxicity evaluations.

79-2881. Hertz, H. S., ed.; Chesler, S. N., ed. (Cent. Anal. Chem., Natl. Meas. Lab., US NBS, Washington, DC 20234) **Trace organic analysis: a new frontier in analytical chemistry.** *NBS (US) Spec. Publ.* 519: 788 p.; 1979.

The proceedings of a symposium on trace organic analysis are presented, covering such topics as: sampling and sample handling for trace organic analysis, state of the art analytical systems, analytical techniques on the horizon, analysis of nutrients, analysis of organic pollutants and their metabolites in the ecosystem, analysis of drugs in body fluids, analysis of food toxicants, and analysis of hormones and neurotransmitters. The aim of the symposium was to bring together scientists to discuss problems and frontiers in organic analyses. The papers presented emphasize the total analytical process from collection of samples to interpretation of results. Analyses of pesticidal compounds can be found in sections on environmental analysis, food analysis, analytical systems for trace organic analysis and general analytical techniques. A subject and author index are also given at the end of the symposium proceedings.

79-2882. Zandstra, B. H.; Motooka, P. S. (Hortic. Dep., Michigan State Univ., East Lansing, MI 48824) **Beneficial effects of weeds in pest management - a review.** *PANS (Pest Artic. News Summ.)* 24(3): 333-338; 1978 (26 references).

Weeds can contribute toward biological control of insect pests. The flowers of the weeds serve as food for adult insect parasites. Weeds may serve as hosts for non-economic insects which serve as alternative hosts or food for predators or parasites. Weed cover may increase the effectiveness of biological control of pests.

79-2883. Nirula, K. K. (Int. Crops Res. Inst. Semi-Arid Trop., Hyderabad, India) **Relevant crop protection technology for the future.** *Pesticides* 13(6): 15-19; 1979.

The use of pesticides in protecting the food crops of the future in India is considered. While there is need for caution, the overemphasis of the dangers involved in pesticide usage may not always be in the best interests of the needs of the population of the country. The greatest need lies in the development of selective pesticides specific for targeted pests that do not affect the surrounding ecosystem. While progress in this field may be slow in coming, there are ways of using presently available insecticides so that their ecological selectivity is enhanced. The timing of pesticide application is viewed as exceedingly significant, as well as is the placement of the chemicals. The effectiveness of the pesticide can be influenced to some degree by the way in which it is formulated so that various choices should be considered.

79-2884. Hameed, S. F.; Sharma, S. C. (Dep. Entomol. Zool., Coll. Agric., Himachal Pradesh Univ., Palampur

176061 Kangra, India) **Biological performance of insecticides in relation to their consequent pollution in environment.** *Pesticides* 13(5): 24-27, 30; 1979 (6 references).

The persistence of pesticides is discussed in relation to the soil, air, water, crops for animal feeds, eggs, meat for humans, and the human body. The significance of the pesticide residues lies in their effects on the biological systems exposed to them. Studies made on the persistence of these chemicals have two main objectives: the first is to determine what the waiting period must be before safe reentry to the sprayed areas can be made, and the second is to allow determination of the residue still present in the crop at the harvest time. An increasing awareness has arisen of the need to develop chemicals that provide an effective, economic and specific pest control schedule which would not cause unwanted side effects in the environment.

79-2885. Ramakrishnan, N.; Kumar, S. (Div. Entomol., Indian Agric. Res. Inst., New Delhi 110012, India) **Status of *Bacillus thuringiensis* with reference to the silkworm, *Bombyx mori*.** *Pesticides* 13(6): 28-30; 1979 (6 references).

Use of *B. thuringiensis* as a microbial pesticide and its possible effects on silkworms are discussed. A new development in this area of concern has been the production of a strain of *B. thuringiensis* AF 101 which exhibits low toxicity to silkworm and a high toxicity to other crop pests. Advantages of using *B. thuringiensis* in pest control measures are listed. *B. thuringienses* does not multiply vigorously in the soil or become an environmental problem. Its persistence is limited also by its spores which are inactivated by sunlight.

79-2886. Anonymous**List of insecticides which have been considered by the registration committee under the Insecticides Act, 1968.** *Pesticides* 13(6): 62; 1979.

A listing is given of the insecticides that have been approved for use or denied registration under the Indian government's Insecticides Act of 1968. Dieldrin is listed for use in certain desert areas, while endrin and parathion have been phased out of use. Of the remaining 130 compounds mentioned, 111 have been granted registration and 19 have not been approved for registration.

79-2887. Robbins, A. (Off. Dir., NIOSH, Rockville, MD 20857) **Dioxin studies.** *Science* 205(4413): 1332; 1979.

The National Institute for Occupational Safety and Health is compiling a registry of the chemical workers in the US who have had documented exposure to the constituents of Agent Orange, such as 2,3,7,8- tetrachloro dibenzo-*p*- dioxin, either during the manufacture of 2,4,5-T and other herbicides or during industrial accidents. Trends in exposed worker mortality will be analyzed, and mortality and reproductive studies are planned.

79-2888. Jurgens-Gschwind, S.; Jung, J. (Badische Anilin & Soda-Fabrik AG, D-6703 Limburgerhof, BRD) **Results of lysimeter trials at the Limburgerhof facility, 1927 - 1977: the most important findings from 50 years of experiments.** *Soil Sci.* 127(3): 146-160; 1979 (24 references).

A summary of results of 50 yr of experimentation of plant-soil systems is presented. Among the most important conclusions drawn from over 1.5 million soil and 190,000 crop analyses is that the lysimeter trial is an accurate aid for establishing nutrient balances for the plant soil system. Among factors influencing transportation of substances into the soil are environmental considerations (weather, soil type, and vegetative cover) and the nature of the nutrient. Nitrogen and calcium are easily displaced and leached out of the soil, while the mobility of Mg and K is considerably less. Phosphorous is the least mobile primary nutrient in the soil, most of it is removed by the crop stand. Experiments with pesticides have shown that hormone-like weed killers such as 2,4-D, 2,4,5-T, and MCPA were not present in any sample percolate. Other herbicides (pyrazon, fluochloralin, and chlormequate chloride) were likewise not measurable at a depth of 1 m at a detection limit of 0.002 ppm.

79-2889. USDA, Washington, DC; US EPA, Washington, DC**Symptosium on the use of herbicides in forestry.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) 213 p.; 1978.

Proceedings of a symposium held in Arlington, VA in February 1978 which was aimed at exploring the role of herbicides in forest integrated pest management programs are presented. Speakers at the symposium were selected to represent the views of the Environmental Defense Fund, the USDA Science and Education Administration, the Forest Service, and the US EPA. Prior to panel discussions, several keynote addresses introduced topics in the field of herbicide use in forestry. References to other research in the field are then listed, and notes of panel discussions follow. Post symposium responses to questions appear after the appropriate panel discusions. A summation of the proceedings, as well as a complete list of affiliations of all speakers are also included in this book.

79-2890. Blair, E. H. (Health & Environ. Res., Ag-Org. Dep., Dow Chem. Co., Midland, MI 48640) **The challenge of developing safe and effective chemicals for creating a productive forest environment.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 21-44; 1978 (8 references).

A paper is presented in which various apsects of the development of pesticides is discussed. The cost of developing a pesticide is 15 million, and 15-18 yr are required. The stages, or time intervals, of cost flow are identified, beginning with exploration and ending with the sales

stage. Pesticides are only used once or twice during the forest's life, as opposed to the yearly applications in the case of corn. It is argued that greater leadership of the agencies in articulating the limited risks of using pesticides in forests is required. It is also suggested that the information on toxicity, fate, and effects is adequate, and that further studies would be a waste of time and money. Some ideas are presented for regulatory policies that are consistent with sound public policy. Registration of current herbicides should not be withdrawn without serious thought because it is difficult for the chemical industry to stop production, and then suddenly begin again. It is believed that legal and bureaucratic entanglements can be avoided if trust is established between industry, universities, and government. A panel discussion then follows in which plans for a laboratory audit program are elaborated.

79-2891. Witt, J. M. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR 97331) **Classification of silvicultural herbicides.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 45-52; 1978.

The classification of herbicides, forest service usage of herbicides, and the modes of action of herbicides are presented. A few of the more important families of herbicides, classified according to structure, are presented. The basic chemical structure common to members of each group are described, and the ten herbicides most commonly used by the US Forest Service are discussed. The compounds 2,4-D, 2,4,5-T and picloram are the top three, with 232,395, 86,023, and 61,958 lbs, respectively, having been used during fiscal year 1976. The modes of action of herbicides are divided into two groups: plant hormone-like action (such as cell growth, cell division and growth abnormalities); and the inhibiton of photosynthesis (such as respiration, Hill reaction, and protein synthesis). The distinction is made between the toxicity of a compound (inherent property of a molecule) and its hazards (a function of how much is used and how it is used).

79-2892. Cranmer, M. (Natl. Cent. Toxicol. Res., Pine Bluff Arsenal, Jefferson, AR 72079) **Toxicology of families of chemicals used as herbicides in forestry.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 53-69; 1978 (45 references).

An introduction to the toxicology of pesticides used in forests and, a discussion of the general uses of forest lands is presented. All forest land is wildlife habitat and can be used for outdoor recreation. Herbicide use depends on whether or not the area is designed for human visitors. Pesticide residue build up is a problem when areas for forage production, as well as urban and suburban forests, are being managed. Laboratory toxicity studies show that dioxin (TCDD) contaminating 2,4,5-T at 30 ppm has caused increased cleft palate and cystic kidney in mice. Little or no teratogenic effects of 2,4,5-T have been reported. The ecological burdens of dioxin contamination from 2,4,5-T applications over a 20 yr periods were calculated. The use of dinitrophenols has caused acute poisoning in man with symptoms of gastric upset, nausea, rapid respiration and finally collapse and coma. Blood levels below 10 ppm for considered trivial; levels of 50 ppm are dangerous. The oral LD50 of dinitro-*o*-cresol (DNOC) in rats is 30 mg/kg. Bipyridyl compounds (paraquat and diquat) have been responsible for accidental and suicidal death in humans. The LD50 for paraquat in guinea pigs, cats and cows range from 30 to 50 mg/kg, 125 mg/kg for rats and 40 mg/kg for man. Carbamate herbicides have low acute toxicities (LD50 of 5000 mg/kg for rabbits, 600 mg/kg for rats). Substituted ureas also have low toxicities (3000 mg/kg for rats). Most triazines have oral toxicities above 1000 mg/kg. Amide herbicides have relatively high oral LD50 values for rats.

79-2893. Offutt, C. K. (Dioxin Monit. Program, Off. Pestic. Programs, US EPA, Washington, DC 20460) **EPA monitoring studies - a case history on dioxin.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 77-81; 1978 (3 references).

The risk of the contaminant dioxin (TCDD) must be considered when regulating the phenoxy herbicides. A planning conference was held in 1974 to discuss a final determination on whether 2,4,5-T causes unreasonable adverse effects. A two-phase plan was evolved. Phase I was the development of extraction procedures to recover 50% of the dioxin. A status report on this phase has not yet been released. Phase II will be a validation of the methods being developed in phase I. It was concluded that the 3-yr-old dioxin implementation plan has resulted in much progress in the analytical methodology for very low levels of dioxin.

79-2894. Streisinger, G. (Inst. Mol. Biol., Univ. Oregon, Eugene, OR 97403) **Assessment of hazards posed by TCDD.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 101-103; 1978 (5 references).

The problems of assessing the hazards of TCDD are discussed. Dioxin concentrations in beef from a rangeland sprayed with 2,4,5-T ranged from 5 to 65 ppt. Twelve to 143 ppt were found in cattle in a similar study. The question was raised as to whether or not these levels pose a threat to human health. Low levels of TCDD (3.4 μg/kg) were fed to monkeys over long periods of time (408 meals). Individual animals responded differently. Some were killed by 500 ppt dioxin, and some appeared normal at that level of exposure. It was impossible to prove that the observed harm was due to pesticides. However, it was suggested that a value of 100-fold less than the determined no effect level for monkeys be adopted as a level safe for humans. An example of a fish kill below a forest sprayed with 2,4-D and 2,4,5-T is given. After the area was

sprayed, fish began dying and the phenoxy herbicides were detected at levels of 0.4 ppb in the water. It is suggested that the fish kill was not due to the herbicides, and that widescale epidemiological studies would be necessary to determine that exact cause of fish mortality.

79-2895. Carter, M. C.; Holt, H. A.; Rickard, W. (Dep. For. & Nat. Resour., Purdue Univ., West Lafayete, IN 37907) **Alternative methods of vegetation management for timber production.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 128-150; 1978 (28 references).

A comprehensive discussion of cost/benefit ratios from the use of herbicides in forestry is presented. Minor uses of herbicides (such as weed control in tree nureseries, seed orchards, firebreaks, and roadsides), as well as major uses (including the use of 2,4-D and 2,4,5-T for competition control in forest stands) are described. In order to analyze the cost/benefit relationship, the expected gains in industrial forest productivity as a result of weed control practices are presented. The projected gains range from 70-100% increases. The cost in dollars of the various weed control methods are presented, along with the benefit/cost ratio of each. It is shown that chemical means are more cost effective than mechanical methods, and manual methods are the least cost effective. It is predicted that the loss of 2,4,5-T would cause slower forest growth and lower harvest, with resultant economic implications. In an ensuing panel discussion, an opinion that 2,4,5-T and its contaminant TCDD may be no more harmful than alternative weed control methods, and conflicting views on the cost of manual methods are presented. Data on direct and indirect effects of herbicides on wildlife are presented, generally showing no observable effects.

79-2896. Scifres, C. J. (Dep. Range Sci., Texas A&M Univ. College Station, TX 77843) **Range vegetation management with herbicides and alternative methods: an overview and perspective.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 151-170; 1978 (68 references).

The evolution of herbicide use in rangeland is discussed. No single approach (chemical, mechanical, biological or burning), however, can be viewed as an ultimate practice. Management systems should be set up and only methods of control which are adaptable into that system should be used. Methods of brush management are also discussed. Physical methods are successful, generally, in low brust density situations. Biological techniques are generally not highly efficient, thè use of goats in Texas being the only proven exception. Burns produce air quality problems. The most modern procedures combine herbicide use and prescribed burns. Overviews are presented on the use of herbicides in wildlife habitats and range environments. Benefit/cost relationships of herbicide use on rangelands are discussed. Grass production in experimental plots (sprayed with phenoxy herbicides) and control, show a great increase under a spraying regime. Control area production was 39.15, 18.90, and 16.20 kg/acre per inch of precipitation for the treatment in the first, second, and third yr, respectively. A combination of 2,4,5-T and picloram resulted in 56.70, 44.55, and 35.55 kg/acre per inch of precipitation for the same three yr. There have been many recent advances in herbicide technology for range improvement. The development of mixtures of herbicides and the development of dry herbicide formulations associated with application technology are two of the important areas in which the technology of pesticides has been improved.

79-2897. Andres, L. A.; Swezey, S. L.; Vogl, R. J. (Biol. Control Weeds Lab., ARS, USDA, Albany, CA 94706) **The role of biological control, intensive skilled labor, and controlled fire in achieving realistic vegetation management objectives.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC) pp. 187-207; 1978 (65 references).

Selected means of achieving vegetation contol are discussed. Biological control is currently focusing on the use of pathogens as host-specific control agents. Natural control agents and competitors are also useful. Goats, sheep, cattle, herbivorous fish and competitive plants have been successful. Intensive labor has not been widespread since the 1930's. However, an experimental program has been initiated by the National Forest Service in which chain saws and brush hooks are used to cut competitive species from around potential crop trees. The method is highly selective and the cost is highly variable; depending upon the training of personnel. Further studies must be conducted before the total cost/benefit of larger projects can be determined. Fire can be used in many ways as a management tool, including regulation of plant development of succession, thinning forests, clearing vegetation, stimulating new growth, preparing seedbeds, and creating diversity. The fact that chemicals are used is not the main concern; the methods and quantities used are more important. The use of non-chemical alternatives improves control, or management because it allows for the conservation of and cautious use of herbicides.

79-2898. Murray, F. J.; Smith, F. A.; Nitschke, K. D.; Humiston, C. G.; Kociba, R. J.; Schwetz, B. A. (Toxicol. Res. Lab., Health & Environ. Sci., Dow Chem. Co. USA, Midland, MI 48640) **Three-generation reproduction study of rats given 2,3,7,8-tetrachlorodibenzo- *p*- dioxin (TCDD) in the diet.** *Toxicol. Appl. Pharmacol.* 50(2): 241-252; 1979 (18 references).

A three-generation reproduction study was conducted to evaluate the effects of chronic, low-level ingestion of 2,3,7,8-tetrachlorodibenzo -*p*- dioxin (TCDD). Sprague-Dawley rats were maintained continuously on

diets providing dose levels of 0, 0.001, 0.01, or 0.1 μg TCDD/kg/day. No significant toxicity was noted in the f_0 rats of either sex during the 90 days of TCDD ingestion prior to mating. Significant descreases in fertility and neonatal survival were observed in the f_0 generation rats receiving 0.1 μg TCDD/kg/day; these effects precluded continuation of this high dose level in subsequent generations. At 0.01 μg TCDD/kg/day, fertility was significantly decreased in the f_1 and f_2 but not f_0 generations. Other indications of toxicity seen at 0.01 μg TCDD/kg/day included decreases in litter size at birth, gestation survival (proportion of pups born alive), and neonatal survival and growth. Among the rats receiving 0.001 μg TCDD/kg/day, no effect on fertility, litter size at birth, or postnatal body weight was observed in any generation. No consistent effect on neonatal survival was observed at 0.001 μg TCDD/kg/day. In summary, the reproductive capacity of rats ingesting TCDD was clearly affected at dose levels of 0.01 and 0.1 μg TCDD/kg/day, but not at 0.001 μg TCDD/kg/day, through three successive generations. (Author abstract by permission)

79-2899. Price, D. R. H. (Author address not given) **Fish as indicators of water quality.** *Water Pollut. Control* 77(2): 285-296; 1979 (42 references).

The current and potential uses of fish for water quality management purposes are reviewed. The accumulation of such substances as organochlorine insecticides, polychlorinated biphenyls, cadmium, and mercury in fish established them as biological monitors of environmental pollutants. Natural fish populations are important indicators of general water quality but are not suitable for providing a detailed scientific assessment. Fish in cages suspended in waterways or effluent can be used to indicate water quality, but disadvantages include high labor demands. Laboratory toxicity studies are effective but require the transportation of large water samples. The maintenance and monitoring of breeding populations in sewage treatment plant effluent is used to protect fish in receiving waters. Field laboratory toxicity testing has demonstrated promise for automatic monitors employing fish. There are differences in the sensitivity required by such monitors for fisheries and potable water supplies.

79-2900. Wagner, S. L. (Environ. Health Sci. Cent., Oregon State Univ., Corvallis, OR) **The safety of agricultural chemicals.** *West. J. Med.* 131(2): 156; 1979.

In this letter to the editor the author calls for physicians to become more active in the concern of diseases arising from public exposure to chemicals. The case of the temporary ban on 2,4,5-T is cited as an example where no case of intoxication or adverse effects in humans could be found in the medical literature before the bans went into effect. Physicians are urged to report findings of such cases and document the evidence, rather than just treat the patients. Such documentation will be useful in future decisions to be made concerning whether or not specific chemicals, including pesticides, should be removed from agricultural use.

79-2901. Schaefer, W. W. (Author address not given) **Herbicides and dioxin.** *Wis. Med. J.* 78(8): 18; 1979 (2 references).

A short summary is presented of data indicating the hazards of dioxin (TCDD), a contaminant of the herbicides 2,4,5-T and silvex. In one Northern California community, 19 of 30 women gave birth to deformed babies or stillborns over a three year period following aerial spraying with 2,4,5-T. An exceptionally high incidence of spontaneous abortions in the Alsae Basin of Oregon could not definitely be proved to be directly due to the spraying of nearby forests with 2,4,5-T. However, the EPA has placed a temporary ban on the use of 2,4,5-T and silvex in forests and for clearing of highway rights of way. Vietnam veterans exposed to dioxin in the defoliant Agent Orange have reported paresthesias, depressions, decreased concentration, cancer, and congenital abnormalities of offspring. In a study on rats, 38% of the animals fed dioxin for 18 mo developed tumors. Dioxin at a level of 500 ppt is extremely toxic to rhesus monkeys, resulting in death of 5 of the 8 tested.

79-2902. Govaerts-Lepicard, M. (Author address not given) **Poison: not to be taken.** *World Health* 6: 22-23; 1979.

The Belgian Poisons Control Center in Brussels has prepared a listing of the most common causes of poisoning in young children. Ranked third on the list of causitive agents are household insecticides. These are combined with other household products to yield 23.6% of the poisonings in children up to 4 yr of age. Pesticides themselves are listed 5th on the causitive agents list and are responsible for 3.0% of the poisoings in children up to 4 yr of age. Various underlying reasons for these poisoning cases are discussed briefly and the need for better labeling and greater knowledge on the part of the parents of these children is stressed.

79-2903. Matsumura, F.; Esaac, E. G. (Pestic. Res. Inst., Michigan State Univ., East Lansing, MI 48823) **Degradation of pesticides by algae and aquatic microorganisms.** *ACS Symp. Ser.* 99(Ch. 22): 371-387; 1979 (18 references).

The photodecompositin of pesticides by blue-green algae appears to depend on small weight flavoproteins. When flavoproteins were present, an enhancement of the photodegradation of DDT, lindane, dieldrin, toxaphene, parathion and mexacarbate was noted. Similarly a role is also played by these flavoproteins in the reductive degradation of mexacarbate, DDT, and toxaphene, though to a lesser extent, under anaerobic conditions. These findings are significant to the study of pesticide degradation in the aquatic environment by virtue of the fact that the algae is abundant and covers large areas.

79-2904. Ide, A.; Ueno, Y.; Takaichi, K.; Watanabe, H. (Dep. Agric. Chem., Fac. Agric., Yamaguchi Univ., Yamaguchi 753, Japan) **Photochemical reaction of 2,3-dichloro- 1,4-naphthoquinone (dichlone) in the presence of oxygen.** *Agric. Biol. Chem.* 43(7): 1387-1394; 1979 (12 references).

Reductive dehalogenated compounds of 2,3-dichloro- 1,4-naphtho quinone (dichlone), such as 2-chloro- 1,4-naphtho quinone, 1,4-naphtho quinone and 1,4-naphthalene diol, were produced during the initial stage of photochemically reacting dichlone in various solvents either in the presence or absence of oxygen. On longer photoreaction in the presence of oxygen, phthalic acid and phthalic anhydride (phthalic acid mono ester instead of the anhydride in an alcoholic solvent) were isolated as the main products. Minor products of reacting dichlone in a mixture of benzene and 2-propanol were salicylic acid, 2-chloro- 3-hydroxy- 1,4-naphtho quinone, 2-chloro- 3-phenoxy- 1,4-naphtho quinone and 2,3-dichloro- 4-hydroxy-1- keto-2-phenyl- 1,2-dihydro naphthalene, and isopropyl 1-chloro- 2,3-dioxo-1- indanecarboxylate. (Author abstract by permission)

79-2905. Uhnak, J.; Mahelova, E.; Sackmauerova, M.; Tibenska, M. (Hyg, Cent. Krajska Hyg. Stn., Res. Inst. Prev. Med., Bratislava, Czechoslovakia) **Transfer rezidui hexachlorbenzenu a chlorovanych insekticodov z pody do rastlin. [Transfer of HCB and chlorinated insecticides from soil to plants.]** *Agrochemia* 19(5): 154-156; 1979 (17 references) (Slovak).

DDT, γ-HCH (lindane) and HCB (hexachlorobenzene) residues were determined in the soil and carrot and potato crops in 6 Slovak districts over a 3-yr period from 1975 to 1978 by TLC and gas chromatography. For carrots (A=variation treated with 1.5 kg/ha and B=variation treated with 3 kg/ha lindane) the highest levels of γ-HCH residues were found for both A and B in the third vegetative mo which thereafter decreased at the end of the 7th mo in the case of A by 95% and in that of B by 94% compared to the third mo level. This phenomenon was attributed to the exhaustion of soil residues in the immediate vicinity of the plants. HCB levels found in potatoes were approaching the respective DDT + DDE levels found in the soil while HCH and DDT residues were higher in potatoes than in the soil, which was attributed to the difference in water solubility of HCB and γ-HCH. No great differences were found in the level of residues of crops from the various districts. Potatoes contained the highest levels of γ-HCH followed by DDT, DDE, HCB and β-HCH (β-BHC) in that order. It is concluded that the use of HCB in agriculture should be forbidden.

79-2906. Fisyunov, A. V.; Litvinov, A. S. (Agric. Inst., Poltava, USSR) **Vliianie gerbitsidov na svoistva vyschelochennogo chernozema i urozhai kukurusy. [Effect of herbicides on properties of leached chernozem and corn yield.]** *Agrokhimiya* 18(5): 99-104; 1979 (27 references) (Russian).

This study was designed as an attempt to evaluate the effect of soil herbicides (linuron, polytriazine, prometryne and their mixtures) on the biological activity of leached chernozem and the yield of corn. It was found that application of linuron (5 kg/ha) completely controlled annual weeds, improved the water and nitrate regimen of soil, and preserved the corn yield. Polytrazine, prometryne and their mixtures resulted in 70-80% control of annual weeds, better utilization of soil moisture and nitrates, and an increased yield of corn.

79-2907. Greaves, M. P. (Agric. Res. Counc., Weed Res. Organ., Yarton, Oxford, England) **Long-term effects of herbicides on soil microorganisms.** *Ann. Appl. Biol.* 91(1): 129-132; 1978 (9 references).

The effects of long-term usage of herbicides on the soil microflora populations, microorganism processes, and soil enzymes, are reviewed. Most investigations on these topics have considered the long-term effects of triazines such as simazine. Occasional reductions in mineral nitrogen levels and in respiration were associated with simazine use of 7 to 8 yr duration. Five to 10 applications of 5, 10, or 20 kg/ha simazine had little direct effect on soil microflora and its biochemical activity in a corn field. Nine annual applications of 3.4 kg/ha of atrazine did not affect soil enzymes. Published studies reveal little evidence of direct effects of herbicides as most effects appear to be indirect effects resulting from reductions in soil organic matter. Studies are needed on the effects of herbicides on the organisms living on the roots of treated plants, and effects on plant root morphology.

79-2908. Kutz, F. W.; Strassman, S. C.; Sperling, J. F. (Ecol. Monit. Branch, US EPA, Washington, DC 20460)

Survey of selected organochlorine pesticides in the general population of the United States: fiscal years 1970-1975. *Ann. NY Acad. Sci.* 320: 60-68; 1979 (12 references).

Human adipose tissue samples were collected and analyzed for *o,p'*-DDT, *p,p'*-DDT, *o,p'*-DDE, *p,p'*-DDE, *o,p'*-DDT, *p,p'*-DDD (TDE), α-BHC, β-BHC, lindane, δ-BHC, aldrin, endrin, dieldrin, heptachlor, heptachlor epoxide, oxychlordane, *trans*-nonachlor, mirex, hexachlorobenzene, and polychlorinated biphenyls. In general δ-BHC, aldrin, heptachlor, and endrin were not found in the samples studied. Low levels, but widely distributed ones, of β-BHC were found, indicative of exposure to benzene hexachloride insecticide. Dieldrin levels were found in almost every tissue collected, and remained relatively unchanged during the 6 yr of the study. Dieldrin residues were indicative of exposure to aldrin and dieldrin. Heptachlor epoxide, indicating exposure to heptachlor and chlordane, was found at low levels in most samples. Oxychlordane, from chlordane and heptachlor, was found with high frequency at levels of about 0.10 ppm in adipose tissue. Hexachlorrobenzene was also found to be disributed ubiquitously in the human population.

79-2909. Jensen, S.; Jansson, B.; Olsson, M. (Natl. Swed. Environ. Protect. Board, Spec. Anal. Lab., Wallenberg Lab., Univ. Stockholm, Stockholm, Sweden) **Number and identity of anthropogenic substances known to be present in Baltic seals an their possible effects on reproduction.** *Ann. NY Acad. Sci.* 320: 436-448; 1979 (26 references).

Studies have been made over recent years of DDT and PCB contamination of seals in the Baltic Sea. Hydroxylated metabolites of these chemicals were measured. Seals have exhibited problems in reproduction, which were particularly noticeable in the grey seal, the harbor seal, and the ringed seal. DDT and PCB levels were found to be significantly higher among the nonreproducing group than in the reproductive group of seals. The fate of the Baltic seal population is considered with the resulting conclusion that, unless efforts are made to stop the pollution of their living areas with these chemicals, the seal population will die out.

79-2910. Lipka, E.; Doboszynska, B. (Inst. Bromatol., Acad. Med., PL-80416 Gdansk, Poland) **Zawartosc DDT w rybach slodkowodnych polawianych na polnocnych terenach Polski. [DDT content in freshwater fish netted in Northern Poland.]** *Bromatol. Chem. Toksykol.* 11(3): 293-296; 1978 (2 references) (Polish).

DDT content was determined in 280 specimens from 11 freshwater fish species netted from 1972-1974 in Northern Poland lakes and Baltic Sea bays. Total DDT content, calculated as the sum of DDT, DDD (TDE), and DDE, varied from 0.05 to 3.4 mg/kg, depending on the fish species. It was lower in lean fish than in fat ones. The amount of DDT in fish netted in Baltic bays was higher, suggesting greater pollution of the Baltic with organochlorine pesticides. No increase in the average DDT content was observed within the period of 1972-1974.

79-2911. Miles, J. R. W.; Moy, P. (Res. Inst., Agric. Canada, London, Ontario, N6A 5B7, Canada) **Degradation of endosulfan and its metabolites by a mixed culture of soil microorganisms.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 13-19; 1979 (9 references).

Sandy loam soil was mixed with water, nutrients (for soil microorganisms), and α- or β-endosulfan. After 1, 2, 3, 4, 6, 8, 12, 16 or 20 wk, 10 ml aliquots were removed and analyzed by gas chromatography. The pathway of degradation shown is for both α- and β-endosulfan degrading to endosulfan sulfate or endosulfan-diol. Endosulfan α-hydroxyether is then formed, either directly or by an endosulfan ether intermediate. The final product is endosulfan lactone. It is interesting to note that when the mixtures are incubated in the absence of microorganisms, the first reaction does not include the endosulfan sulfate intermediate, and the endosulfan ether intermediate in the production of endosulfan α-hydroxyether is eliminated. The time for 50% degradation of endosulfan metabolites varies from 5.5 hr for endosulfan lactone to 14 wk for endosulfan diol.

79-2912. Niimi, A. J. (Great Lakes Biolimnol. Lab., Canada Cent. Inland Waters, Burlington, Ontario L7R 4A6, Canada) **Hexachlorobenzene (HCB) levels in Lake Ontario salmonids.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 20-24; 1979 (17 references).

Whole lake and rainbow trout and coho salmon from the eastern basin of Lake Ontario were homogenized and analyzed for hexachlorobenzene (HCB) levels by gas chromatography. HCB levels averaged 80 ng/g for lake trout, 62 ng/g for rainbow trout, and 36 ng/g for coho salmon. The levels increased significantly with body weight for all species. For fish of the same weight, HCB levels were highest in lake trout, followed by rainbow trout, and coho salmon.

79-2913. Berard, D. F.; Rainey, D. P. (Agric. Biochem., Lilly Res. Lab., Greenfield, IN 46140) **Dissipation of ^{14}C *N*-nitroso- di-*N*- propylamine from field soil and residue determinations in field-grown soybeans.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 141-144; 1979 (4 references).

Two plots of soybeans were tested by applying ^{14}C-*N*- nitroso-di- *N*-propylamine (NDPA, trifluralin) at 571 μg/m². Soil samples 8 cm deep were taken 2 hr, 8 and 49 days after application. Plants were removed 21 and 49 days after treatment. Soil samples and plant tissues were assayed for total radioactivity. Results showed that 47% of the NDPA was lost immediately due to volatilzation. The

level of soil radioactivity continued to decline; after 49 days, only 11% remained. After 49 days, the NDPA was at 0.00013 ppm in plot 1 and 0.00010 ppm in plot 2. Radioactivity in seeds produced in the plots was 0.00024 and 0.00013 ppm, which did not exceed levels in seeds produced in untreated plots.

79-2914. Christensen, E. J.; Olney, C. E.; Bidleman, T. F.* (Dep. Chem., Univ. South Carolina, Columbia, SC 29208) **Comparison of dry and wet surfaces for collecting organochlorine dry deposition.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 196-202; 1979 (10 references).

A study is presented in which aerial transport of organochlorines (OC) was studied. Measurements of OC fall out were made with dry dishes or with dishes with a layer of ethylene glycol, water, or glycerin-water, in Kingston, RI or Columbia, SC. Analysis was carried out by electron capture gas chromatography. Wet pans retained 1.5-3 times more OC than dry pans. Differences between the different liquids were small. Mean fallout fluxes in $mg/m^2/day$ were 230 and 68 for Aroclor 1016 at the RI and SC collection stations, respectively. Aroclor 1254 mean values were 224 and 124 for the two sites. Chlordane mean values were 0.0 for RI and 14 for SC. *p,p'*-DDT mean values were 89 and 31 for the two sites, respectively.

79-2915. Garcia, J. D.; Rhodes, M. J. (Dep. Range & Wildl. Manage., Texas Tech Univ., Lubbock, TX 79409) **Residues of 2,4,5-T in the American coot (*Fulcia americana*).** *Bull. Environ. Contam. Toxicol.* 23(1-2): 231-235; 1979 (18 references).

Twenty-nine coots were shot at White River Lake, TX and were analyzed for 2,4,5-T and TCDD. No TCDD was detected in any samples, and no 2,4,5-T was detected in brain and heart samples. Residues of 2,4,5-T were detected in breast muscles of 14 birds (range 8.0 - 1,338 ppb), liver in 5 birds (range 2.0 - 118 ppb), and in gizzards of 5 birds (range 6.0 - 41.0 ppb). When considering the means, breast muscle contained the greatest amount, followed by liver, fat, and then gizzard.

79-2916. Peakall, D. B.; Gilman, A. P. (Wildl. Toxicol. Div., Canadian Wildl. Serv., Environ. Canada, Ottawa, Ontario K1A 0E7, Canada) **Limitations of expressing organochlorine levels in eggs on a lipid-weight basis.** *Bull. Environ. Contam. Toxicol.* 23(3): 287-290; 1979 (7 references).

In this overview, the limitations of expression the results of analysis of eggs on a lipid-weight basis is discussed. It was determined that the percentage of lipid in yolk and albumen in the eggs of herring gulls does not change significantly during incubation. Therefore, if traces of yolk and albumen are extracted from broken shells and analyzed, the results should not be biased by the degree of incubation when results are expressed on a lipid-weight basis. It is contended, however, that in the use of homogenized eggs, one must take into consideration the shifting ratio of lipid in the combined yolk and albumen (9-11%) to that of the embryo (2-3%) as the embryo grows. Lipids decreased over 50% during incubation. Pesticide residue levels calculated on a lipid-weight basis varied between 143% and 298% through incubation; wet weight based calculations varied between 23% and 26%; dry weight based calculations varied between 18% and 34%. It is suggested that the use of lipid-weight as a basis for expressing pollutant levels is erroneous, unless the degree of incubation is known.

79-2917. Rabeni, C. F.; Stanley, J. G. (Maine Coop. Fish. Res. Unit, Dep. Zool., Univ. Maine, Orono, ME 04469) **Operational spraying of acephate to suppress spruce budworm has minor effects on stream fishes and invertebrates.** *Bull. Environ. Contam. Toxicol.* 23(3): 327-334; 1979 (18 references).

Studies were performed to determine the effects on stream life of spraying nearby forest lands with acephate. One hr, 1 and 2 days after spraying was performed at two sites, water samples were collected and analyzed. Fish were collected and brain AChE was determined. Fish were collected for 6 mo following spraying, their stomach contents were analyzed, and growth and condition factors were determined. One hr after spraying, pesticide levels were 140 and 113 ppb in water at the two respective sites. By day 2 the levels were 41 and 9 ppb, respectively. There was a drop in AChE activity in the brains of all fish within 1-4 days after spraying, generally followed by an increase to higher than original levels. After spraying, the fish diets were altered due to opportunistic feeding of terrestrial insects. No difference in growth occurred between fish from treated and control areas. Population densities of benthic insects were not affected by spraying; however, drift increased after spraying. It was concluded that acephate caused local, minimum damage to the stream ecosystem.

79-2918. Holcomb, C. M.; Parker, W. S. (Dep. Phys. Sci., Mississippi Univ. Women, Columbus, MS 39701) **Mirex residues in eggs and livers of two long-lived reptiles (*Chrysemys scripta* and *Terrapene carolina*) in Mississippi, 1970-1977.** *Bull. Environ. Contam. Toxicol.* 23(3): 369-371; 1979 (5 references).

Experiments were carried out to determine the levels of mirex in eggs and livers of slider turtles and terrestrial box turtles. The animals were collected in 1970, 1972, 1974, 1975 and 1977 in an area that received four applications of 5% mirex for fire ant control. Significant levels of the pesticide were found in the eggs and livers of both species. Liver values for the sliders ranged from 0.01 to 2.1 ppm. Egg levels for the slider ranged from 0.04 to 2.2 ppm. Pesticide levels in the box turtle ranged from 0.68 to

4.1 ppm in liver and from 1.4 to 2.5 ppm in eggs. The terresrrial box turtle showed higher levels than the aquatic sliders. Concentratons dropped off after 1972, despite an application of mirex in 1974, which had no apparent effect on the sliders.

79-2919. Ahmad, N.; Walgenbach, D. D.; Sutter, G. R. (Entomol. Zool. Dep., South Dakota State Univ., Brookings, SD 57006) **Comparative disappearance of fonofos, terbufos, and phorate soil residues under similar South Dakota field conditons.** *Bull. Environ. Contam. Toxicol.* 23(3): 423-429; 1979 (5 references).

A study was designed to determine the disappearance of the soil residues of the soil insecticides fonofos, terbufos, and phorate. In May 1976 field A containing 9 insecticide plots was established, and in May 1977 field B containing 7 plots was set up. Each plot was 2 x 3.5 m. Granular formulatons of fonofos 20 G (440 mg field A and 26 mg field B), terbufos (880 mg field A and 34.6 mg field B), and phorate 15 G (880 mg field A and 34.6 mg field B) were applied to soil areas enclosed in PVC containers, then covered with 2 cm of soil. The amount of insecticide applied on field A yielded 19 kg AI/ha, and at field B, 1.1 kg AI/ha. The insecticides and their oxidized products were extracted from soil samples, using a mixture of chloroform an methanol for phorate and terbufos, and benzene for fonofos. The extracts were assayed with a gas chromatograph equipped with an N-P-FID detector. Fonofos disappeared from the soil at a much slower rate than the other two compounds. After 84 days, 46 ppm fonofos remained in the soil, wherease only 0.2 ppm phorate and 0.08 ppm terbufos remained. Degradation of phorate and terbufos yielded increasing levels of phoratoxin and terbufoxon sulfones, which are more persistent than their parent compounds. It is thought that the differential degradation of these insecticides may be an important determinant for their field performance.

79-2920. Zimmerli, B.; Zimmermann, H.; Marek, B. (Dep. Food Monit., Pestic. Residue & Contam. Sect., Fed. Health Off., CH-3008 Bern, Switzerland) **Der Uebergang Biozider Stoffe aus Anstrichen in die Gasphase. Endosulfan. [Transfer of biocidal materials from paint into the gas phase. Endosulfan.]** *Chemosphere* 8(7): 465-472; 1979 (7 references) (German).

Concentrations of α- and β-endosulfan sublimated from a wood preservative-coated room into the room atmosphere were measured by gas chromatography to determine the degree of potential health hazard within a temperature range of 14-21.4°C. The preservative contained 0.3% α-endosulfan and 0.15% β-endosulfan. Following application of the wood preservative in 1976, the concentration of α-endosulfan at 20°C was 11.8 μ/m, 3 and 1 yr later 8.5 $\mu g/m^3$ (lower by a factor of 1.4). Within this time period the α- and β-endosulfan ratio decreased from 16.5 to 11.8, also by a factor of 1.4, indicating that β-andosulfan concentration has not diminished over the 1 yr period, and that the α-isomer sublimated into the atmosphere faster than the β-isomer. An individual remaining in the room for 24 hr would ingest 93 μg endosulfan if the pesticide was completely resorbed by the respiratory organs. In addition, endosulfan ingested through contaminated food would increase this amount to 200 μg/day which represents the upper limit of endosulfan tolerance.

79-2921. Shoval, S.; Yariv, S. (Dep. Geol., Hebrew Univ. Jerusalem, Jerusalem, Israel) **The interaction between Roundup (glyphosphate) and montmorillonitllonite. Part 1. Infrared study of the sorption of glyphosate by montmorillonite.** *Clays Clay Miner.* 27(1): 19-28; 1979 (10 references).

The adsorption of glyphosate on montmorillonite was studied to elucidate the adsorption mechanism. The interactions between montmorillonite and Roundup (isopropylammonium salt) from alcohol and aqueous solutions were studied, and results of an investigation into the interaction between montmorillonite and the anionic component of Roundup, glyphosate anion, are presented. Glyphosate was adsorbed by montmorillonite during cycles of drying and wetting of the clay or from aqueous solution in the presence of excess soluble Al and Fe ions. In the first case, the glyphosate anion is protonated and H_3G is formed in the interlayer space. In the second case, the glyphosate anion forms a coordination compound with polyvalent cation. The interactions between gylphosate and montmorillonite differ for the most part from reactons between glycine and montmorillonite.

79-2922. Faber, R. A. (Univ. Wisconsin, Madison, WI) **Chlorinated hydrocarbons: their distribution in tropical ecosystems, lipid interactions, and reproductive impacts in birds.** *Diss. Abstr. Int. B* 40(2): 569-570; 1979.

Analysis of fish and bird eggs from agricultural, coastal, and rain forest ecosystems in 1971 demonstrated that chlorinated hydrocarbon contamination is widespread in northwestern South America. DDT-family compounds were detected in each of 146 samples analyzed. There were great differences among the ecosystems in the degree of contaimination; agricultural ecosystems had the highest levels. Representative levels of DDE in bird eggs include 8.2 ppm (net-weight basis) in cattle egrets (*Bubulcus ibis*) from a cotton-growing region, 0.51 ppm in brown pelicans (*Pelecanus occidentalis*) from the Atlantic Coast, and 0.04 ppm in chestnut-bellied herons (*Agami agami*) from the Amazon rain forest. Low DDE residues in the biota of the Amazon rain forest and the Pacific Coast suggest that the use of DDT in dwellings for malaria control has had small impact on the contamination of the aquatic environment in these areas. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7902400).

79-2923. Draper, W. M. (Univ. California, Davis, CA) **Pesticide Photooxidations in water.** *Diss. Abstr. Int. B* 40(2): 778; 1979.

The instability of a cyclodiene (aldrin) and organophosphate insecticide (disulfoton) and several thiolcarbamate herbicides (drepamon, molinate, and thiobencarb) to near-uv light in dilute aqueous hydrogen peroxide and in methanolic eosin solutions (an established system for generating singlet molecular oxygen) was examined. These chemical probes undergo photooxidation in natural water, but not in distilled water. With one exception, disulfoton, containing an electron-rich sulfide moiety, the compounds examined were unreactive toward singlet oxygen. In the presence of traces of hydrogen peroxide (u*M* levels), pesticides were stable in the dark, but in sunlight or simulated sunlight, rapid dissipation of each compound occurred. The resulting photochemical oxidations included sulfoxidation of phosphorothionates and thiolcarbamates, *N*-dealkylation, hydroxylation of aromatic nuclei, and oxygenation of alkanes and alkenes. A marked similarity between photooxidations sensitized by solutes in natural water and those occurring in dilute aqueous hydrogen peroxide suggests that similar oxidation mechanisms may be involved. The photodecomposition of pesticides in dilute aqueous hydrogen peroxide solutions was further investigated as a laboratory model system for predicting photooxidative transformations likely to occur in natural waters. Photochemical half-lives observed were dependent upon the initial concentration of oxidant and pesticide. Hydroxyl radicals are significant reactants in the system--the nitrophenol isomer distribution resulting from the photooxidation of nitrobenzene was in good agreement with that formed in other systems known to generate hydroxyl. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7917153)

79-2924. Suttman, C. E.; Barrett, G. W. (Inst. Environ. Sci., Miami Univ., Oxford, OH) **Effects of Sevin on arthropods in an agricultural and an old-field plant community.** *Ecology* 60(3): 628-641; 1979 (53 references).

The effects of acute Sevin (carbaryl) applications on the arthropods in an agricultural (oats) community and the subsequent old-field stage were investigated with emphasis on Coleoptera. Four of eight 0.1 ha plots previously sown with oats and fertilized, were sprayed with Sevin 80-WP at a rate of 227 g technical grade/0.1 ha. Pesticide residues on vegetation, and arthropod density and biomass were determined. On the day following Sevin application, residues measured 37 ppm in the 1971 oats community and 30 ppm in the 1972 old-field community. Sixteen days after treatment, residues measured 1.8 ppm in the 1971 oats community and 2.6 ppm in the 1972 old field. Arthropods sampled by the vacuum method decreased in the oat community from 1354 to 475/m² following Sevin application. Herbivorous response was immediate, pronounced, and short term, while carnivorous response was delayed, less pronounced, and long term. The most severely affected were carnivorous Coleoptera. Arthropod biomass in the old field did not significantly decrease after treatment with Sevin, but total arthropod biomass remained below that of control plots.

79-2925. Bijleveld, M.F.I.J.; Goeldlin, P.; Mayol, J. (IUCN, CH-1110 Morges, Switzerland) **Persistent pollutants in Audouin's gull (*Larus audouinii*) in the Western Mediterranean: a case-study with wide implications?** *Environ. Conserv.* 6(2): 139-142; 1979 (8 references).

Three unhatched Audouin gull eggs from the Moroccan coast, and 4 unhatched eggs from the Northern Meditteranean were analyzed for organochlorine pesticides and PCB residues. Chemicals detected included mercury, DDE, PCBs, HCB (hexachlorobenzene), dieldrin, and heptachlor epoxide (HE). Levels were lowest for dieldrin, HE, and HCB in either locality. Concentrations of the pesticides were much lower in the southern region (average 1.94 ppm, 3.82, and 0.76, for DDE, PCBs, and Hg respectively), than in the North (3.76 ppm, 16.75, and 1.12 for these chemicals, respectively). Further increases in DDE levels may lead to a decline in the reproductive success of the species in the Western Mediterranean.

79-2926. Furness, R.; Hutton, M. (Dep. Zool., Glasgow Univ., Glasgow G12 8QQ, Scotland) **Pollutant levels in the great skua *Catharacta skua*.** *Environ. Pollut.* 19(4): 261-268; 1979 (22 references).

Concentrations of cadmium, mercury and selenium were measured in the adult great skua liver and kidney tissues. Mercury levels were also measured in primary feathers. The mean organochlorine levels in muscle and egg samples were also reported. Correlations were established between the levels of mercury, cadmium or selenium in the birds, and the age of the birds. Egg shells seemed to be no thinner than museum shells from the same locality collected before the introduction of DDT to the environment. It is not known presently whether the concentrations of PCB or DDE in the great skuas will impair breeding. It is suggested that this species would be a useful one to employ in monitoring pollutant concentrations in the particular food web of which they are a part.

79-2927. Wszolek, P. C.; Lisk, D. J.*; Wachs, T.; Youngs, W. D. (Dep. Food Sci., Pestic. Residue Lab., Cornell Univ., Ithaca, NY 14853) **Persistence of polychlorinated biphenyls and 1,1-dichloro- 2,2-bis (*p*-chlorophenyl) ethylene (*p,p'*-DDE) with age in lake trout after 8 years.** *Environ. Sci. Technol.* 13(10): 1269-1271; 1979 (39 references).

Lake trout, ranging in age from 6 to 12 yr, were netted in Cayuga Lake in Central New York in 1978 and analyzed for polychlorinated biphenyls (PCBs) and 1,1-dichloro- 2,2-bis (*p*-chlorophenyl) ethylene (*p,p'*-DDE). Fresh weight concentrations in flesh of the 12 yr old fish were about 13 ppm of PCBs and 3-4 ppm of *p,p'*-DDE. The data indicated that, whereas *p,p'*-DDE had decreased considerably, PCB concentrations remained about the same as those in a similar series of aged lake trout sampled from Cayuga Lake in 1970. The PCBs present in the fish most closely resembled Aroclor 1254 but appeared to contain a higher proportion of more highly chlorinated isomers. (Author abstract reprinted by permission of the American Chemical Society)

79-2928. O'Neill, L. (US EPA, Washington, DC) **A DDT legacy.** *EPA J.* 5(8): 11,36; 1979.

The DDT contamination of the Tennessee River in Alabama and the effects of this contamination on the community of Triana are described. Discharges over the 24-yr life of the Olin chemical plant at the Redstone Arsenal combined with gradual erosion of plant settling ponds washed approximately 4000 tons of DDT into the watershed. A US EPA investigation revealed channel catfish which contained quantitites of pesticides in excess of 400 ppm. Blood test of Triana residents uncovered DDT blood levels ranging from 50 ppb to more than 500 ppb, or 14 times higher than the national average. The health implications of high DDT blood levels are unknown, but the FDA prohibition against selling contaminated fish has brought economic havoc to Triana's commercial fishermen. Current Federal aid to the community includes a 100,000 agricultural cooperative, a 22,500 health care planning project, a drinking water monitoring program, and a 500,000 study on the extent of DDT contamination to the river.

79-2929. Kussmaul, H.; Muehlhausen, D. (Inst. Wasser, Boden., & Lufthyg., D-6000, Frankfurt, BRD) **Hydrologische und hydrochemische Untersuchungen zur Uferfiltration. Teil III. Veraenderungen der Wasserbeschaffenheit durch Uferfiltration und Trinkwasseraufbereitung. [Hydrologic and hydrochemical studies in river bank filtration. Part III. Changes in water composition during river bank filtration and drinking water preparation.]** *Gas Wasser Abwasser* 120(7): 320-329; 1979 (25 references) (German).

The potential of obtaining drinking water from polluted river water by river bank filtration was studied in three water works on the Lower Rhine by determining DOC, COD and KMn04 consumption, organochlorine compounds, aromatic amines, cholinesterase inhibitors, inorganic nitrogen compounds, Na, K, Cl, F, *o*-phosphate and borate, hardeners and heavy metals in the water of pumping wells. The wells were situated at distances of 30-60 m from the river bank which was subsequently treated by ozonizaton, filtration through activated carbon, and chlorination. It was concluded that crude drinking water could be obtained even from highly polluted river water if the passage through the soil took several mo and if other precautions were observed. If these conditions are not met some organic compounds will not be decomposed and toxic heavy metals will remain in the water. Treated crude drinking water differed from the untreated soil-filtered water only by its oxygen, ammonium and manganese content. These findings could be applied only to hydrological, geological and technological conditions prevailing at the Lower Rhine.

79-2930. Handa, S. K.; Awasthi, M. D.; Dikshit, A. K.; Verma, S. (Indian Agric. Res. Inst., New Delhi 110012, India) **Note on the dissipation of monocrotophos and endosulfan residues in or on oat crop.** *Indian J. Agric. Sci.* 49(3): 214-217; 1979 (9 references).

Oat crops were treated with monocrotophos 0.03 and 0.5% sprays from 40% EC and endosulfan 0.05 and 0.1% from 30% EC. Plant samples were collected on days 0, 3, 5, 10, and 15 after treatment. Grain samples were also collected on these days. Initial residues of monocrotophos on leaves resulting from 0.03 and 0.05% spray were 4.87 and 7.53 ppm, respectively. Corresponding residues on day 10 were 0.12 and 0.46 ppm. On day 0 the grain samples showed residues of 3.56 and 6.17 ppm, respectively, which decreased at day 10 to 0.07 and 0.23 ppm, respectively. Initial residues on endosulfan on oat leaves resulting from 0.05 and 0,1% spray were 8.50 and 15.17 ppm, respectively. Samples of grain showed initial deposits of 7.13 and 13.98 ppm, respectively. Within 10 days of treatment, grain samples showed 0.59 and 1.27 ppm, respectively. No detectable residues of endosulfan were present on harvested grain.

79-2931. Koltypina, S. B.; Mar'enko, V. G.; Gul'ko, N. B. **Mikrobiologicheskaya aktivnost' pochv' i pod schalfeem muskatnym pri obrabotke diuronom. [Microbiological activity of soil under clary sage after treatment with diuron.]** *Izv. Timiryazevsk. S'Kh. Akad.* (2): 117-124; 1979 (16 references) (Russian).

The effect of diuron on the microflora, biochemical properties, and feeding regime in the soil under clary sage was studied in greenhouse and field trials in the Crimea on southern calcareous black soil. A single treatment reduced weed cover by 70%, but did not greatly destroy soil biocenosis. Diuron produced a beneficial effect on the amount of nitrate nitrogen, and did not contribute to humans decomposition in the soil. There was no harmful after effect on plant productivity or oil yield.

79-2932. Coats, J. R.; Metcalf, R. L.*; Kapoor, I. P.; Chio, L. C.; Boyle, P. A. (Dep. Entomol., Univ. Illinois,

Urbana Champaign, IL 61801) **Physical-chemical and biological degradation studies on DDT analogues with altered aliphatic moieties.** *J. Agric. Food Chem.* 27(5): 1016-1022; 1979 (36 references).

A series of diethoxy 1,1,1- trichloro- 2,2-bis (*p*-chlorophenyl) ethane (DDT) analogs with eight different aliphatic moieites were subjected to photodegradation studies, utilizing a sterile soil, an aqueous solution, and a film on glass. The 2-chloro isobutane analog, a tertiary chloride, was quite photolabile in all trials. Photolability followed the order of the ease of formation of free radicals by loss of chlorine from the aliphatic moiety: tertiary > secondary > primary ≈ no chlorine. Several series of analogs were evaluated for biological degradation rates and products in the following types of studies: housefly synergistic ratios, housefly penetration metabolism excretion, salt marsh caterpillar metabolism, mouse metabolism, and *in vitro* metabolism by mouse liver microsomes. Both aliphatic and aromatic substituents influence biological degradiaton of the DDT analogs. In model ecosystem assessments of environmental fate, the two most important factors affecting bioaccumulation in fish were the type of aklyl chloride and water solubility of the molecule. (Author abstract reprinted by permission of the American Chemical Society.)

79-2933. Schaefer, C. H.; Dupras, E. F., Jr. (Mosq. Control. Res. Lab., Univ. California, Fresno, CA 93727) **Factors affecting the ability of SIR-8514 (2-chloro- *N*-[[[4-(trifluoromethoxy) phenyl] carbonyl] benzamide) under laboratory and field conditions.** *J. Agric. Food Chem.* 27(5): 1031-1034; 1979 (5 references).

SIR-8514 (2-chloro- *N*-[[[-4- (trifluoromethoxy) phenyl] amino} carbonyl] benzamide) is a potent inhibitor of mosquito larval development. Its stability in water is greatly reduced as temperature and pH both become relatively high. Its persistence is not greatly affected by sunlight. In water having a high organic matter content, its persistence appears to be affected by adsorption and by microbial degradation. SIR-8514 is stable on vegetation under field conditions; residues on vegetation can be minimized by application of sand granule formulations. The biological and chemical properties of SIR-8514 are similar to those of diflubenzuron (2,6-difluoro- *N*-[[[4-chlorophenyl] amino] carbonyl] benzamide). (Author abstract reprinted by permission of the American Chemical Society)

79-2934. Carver, R. A.; Griffith, F. D., Jr. (Div. Chem. & Phys., US FDA, Washington, DC 20204) **Determination of Kepone dechlorination products in finfish, oysters, and crustaceans.** *J. Agric. Food Chem.* 27(5): 1035-1037; 1979 (17 references).

Samples of edible porions of crab, fish, and oysters were fortified with Kepone (chlordecone), monohydro Kepone, and dihydro Kepone at two levels and were analyzed for Kepone by a gas-liquid chromatographic method Recoveries of monohydro- and dihydro Kepone closely approximated those of Kepone. Fifteen samples of fish and crab known to be contaminated with high residue levels of Kepone contained an average of 6.8 ± 1.4% of the total residue as monohydro Kepone. Trace levels of dihydro Kepone (< 1 ppb) were detected in these samples. This methods permits environmental monitoring of these residues along with Kepone residues. (Author abstract reprinted by permission of the American Chemical Society)

79-2935. Ku, C. C.; Kapoor, I. P.; Stout, S. J.; Rosen, J. D.* (Dep. Food Sci., Cook Coll., Rutgers Univ., New Brunswick, NJ 08903) **Photodegradation of Cytrolane (mephosfolan) systemic insecticide in the aquatic environment using carbon-13 as a mass tracer.** *J. Agric. Food Chem.* 27(5): 1046-1050; 1979 (6 references).

Photodegradation of mephosfolan (Cytrolane) was studied by exposing approximately equimolar mixtures of either $^{12}C/^{13}C$ imido-labeled or $^{12}C/^{13}C$ ethyl-labeled material to sunlight. Use of the $^{12}C/^{13}C$ mixtures facilitated identification of photoproducts by gas chromatography chemical ionization mass spectroscopy (GC-CIMS) because molecular and fragment ions in the mass spectra appear as doublets. Solvent artifacts and volatile rice paddy water constituents gave mass spectra containing only singlet ions and were ignored. Irradiations were conducted in distilled water, natural water obtained from a flooded rice paddy, and a 27% acetone-water solution. The half-lives for mephosfolan were 18, 14, and 7 days, respectively, and indicated that photosensitization by paddy water constituents and acetone was occurring. The major products identified were cyclic *S,S*- propylene dithiocarbonate, 2-imino- 5-methyl- 1,3-dithiolane, and diethyl phosphate. Minor products were ethyl phosphate, phosphoric acid, and diethyl methyl phosphate. (Author abstract reprinted by permission of the American Chemical Society)

79-2936. Wahid, P. A.; Sethunathan, N.* (Lab. Soil Microbiol., Cent. Rice Res. Inst., Cuttack 753006, India) **Sorption-desorption of α, β, and γ-isomers of hexachlorocyclohexane in soils.** *J. Agric. Food Chem.* 27(5): 1050-1053; 1979 (9 references).

Sorption and desorption of α, β, and γ (lindane) isomers of hexachlorocyclohexane (HCH, BHC) by 12 soils by varying characteristics were studied using uniformly ^{14}C-labeled isomers. Soils showed striking differences in their ability to sorb HCH with sorption ranging from 40 to 96% of the total HCH added. At low equilibrium concentrations no appreciable differences in sorption occurred between the three isomers with respect to individual soil samples; but at higher concentrations sorption of the three isomers within a soil was not always comparable. Organic matter was the most important factor governing the sorp-

tion and desorption of HCH isomers. Sorption increased and desorption decreased with increasing soil organic matter content. The sorption of HCH isomers with unit increase of soil organic matter content from 0 to 3.4% was 41 times more than at organic matter contents over 3.4%. In the absence of organic matter, clay content and free iron oxide were implicated in γ-HCH sorption and free iron oxide alone in β-HCH sorption, while no significant correlation existed between α-HCH sorption and clay content or free iron oxide. Desorption of all three isomers showed a hysteresis effect. (Author abstract reprinted by permission of the American Chemical Society)

79-2937. Spillner, C. J., Jr.; DeBaun, J. R.; Menn, J. J. (Biochem. Dep., Stauffer Chem. Co., Mountain View Res. Cent., Mountain View, CA 94042) **Degradation of fenitrothion in forest soil and effects on forest soil microbes.** *J. Agric. Food Chem.* 27(5): 1054-1060; 1979 (41 references).

Two forest soils were treated with [*ring* ^{14}C] fenitrothion (7.4 ppm in wet soil) and held in a dark growth chamber at 30°C for 50 days. Periodic sampling and analysis revealed that 50% degradation of fenitrothion occurred in 3 days. Furthermore, the transient formation of 3-methyl- 4-nitrophenol (MNP) and the formation of CO_2 and soil-bound radiocarbon as terminal products were also established. Results were similar in both forest soils. After 50 days of incubation of the soils, the originally applied ^{14}C was accounted for as fenitrothion (3-6%), MNP (5-7%), 3-methyl- 4-nitroanisole (4%), CO_2 (35%), and soil-bound radiocarbon (48-50%). The bound radiocarbon was associated mainly with the humic acid and fulvic acid fractions. Minimal degradation occurred in sterilized soils, suggesting microbial activity was responsible for the observed degradation of fenitrothion. Furthermore, the soil microflora were not qualitatively affected by fenitrothion. From these studies fenitrothion can be regarded as a readily degradable insecticide in forest soil which is not deleterious to the forest soil microflora. (Author abstract reprinted by permission of the American Chemical Society)

79-2938. West, S. D.; Day, E. W., Jr.; Burger, R. O. (Agric. Anal. Chem., Lilly Res. Lab., Eli Lilly & Co., Greenfield, IN 46140) **Dissipation of the experimental aquatic herbicide fluridone from lakes and ponds.** *J. Agric. Food Chem.* 27(5): 1067-1072; 1979 (14 references).

The dissipation of the aquatic herbicide fluridone, 1-methyl- 3-phenyl- 5- [3- (trifluoromethyl) phenyl]- 4(1H)-pyridinone, has been determined in experiments conducted in small ponds at three different geographic regions in the United States and in Gatun Lake of the Panama Canal. Fluridone dissipated rapidly from the water, with a half-life averaging 5 days. The dissipation was due in part to deposition on hydrosoil and uptake by aquatic plants, although evidence is presented to suggest photolysis as a contributing mechanism. The accumulation and dissipation patterns of fluridone on hydrosoil were highly variable. The herbicide demonstrated a very low potential for bioconcentration in fish, zooplankton, and aquatic plants. (Author abstract reprinted by permission of the American Chemical Society)

79-2939. West, S. D.; Day, E. W., Jr. (Lily Res. Lab., Eli Lilly & Co., Greenfield, IN 46140) **Determination of volatile nitrosamines in crops and soils treated with dinitroaniline herbicides.** *J. Agric. Food Chem.* 27(5): 1075-1080; 1979 (24 references).

Volatile nitrosamines have been reported to be comtaminants in several dinitroaniline herbicides. Since these nitrosamines are known to be carcinogenic in laboratory animals, it became necessary to analyze crops and soils treated with those herbicides for the presence of nitrosamine residues. In the procedures described, plant tissue was extracted with methanol, and soil was extracted with methanol: water (3:1). Sample extracts were purified by liquid-liquid extraction and alumina column chromatography. Measurement was accomplished by means of a gas chromatograph thermal energy analyzer. The sensitivity of the methods was 0.2, 0.05, and 0.01 ppb for *N*- nitrosodi- *n*- propylamine in crops, soil, and water, respectively. No detectable nitrosamine residues were observed in any crops treated with the herbicides trifluralin, benefin, or oryzalin. (Author abstract reprinted by permission of the American Chemical Society)

79-2940. Ohsawa, K.; Casida, J. E.* (Pestic. Chem. & Toxicol. Lab., Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) **Photochemistry of the potent knockdown pyrethroid kadethrin.** *J. Agric. Food Chem.* 27(5): 1112-1120; 1979 (16 references).

Kadethrin, 5-benzyl- 3-furylmethyl (1*R*,*cis*,*E*)- 2,2-dimethyl-3- (2'-oxo-3'-thiacyclopentylidenemethyl) - 1-cyclopropanecarboxylate, is rapidly photoisomerized to a 1*RS*,cis,trans(*E*,*Z*) mixture, probably via triplet diradicals generated by direct or sensitized photolysis for each of the cyclopropane carboxylate and vinylcarboxylate isomerizations. A thiolactone lactone is formed by attack of the carbonyl oxygen at C-3 of the cyclopropane ring. Other products originate from hydrolysis of the thiolactone and cyclopropane carboxylate ester groups, from oxidation of the furan ring and rearrangement of the intermediate peroxide to a benzyloxy lactone derivative, and from oxidation of the alcohol moiety to benzylfuroic acid. Minor photoproducts are (1'*R*,2'*S*)- and (1'*S*,2'*R*)- epoxykadethrin, phenylacetic acid, benzyl alcohol, and benzoic acid. Kadethrin is more toxic to houseflies and mice than isomerized esters and photodecomposed products derived from it. *d*-2-Octyl (1*R*,*trans*)- chrysanthemate undergoes sensitized photoisomerization much slower than *d*-2-octyl pyrethrate, which in turn is slower than the *d*-2-octyl esters

of the kadethrin acid moiety and the corresponding lactone. (Author abstract reprinted by permission of the American Chemical Society)

79-2941. Fletcher, C. L.; Kaufman, D. D.* (AEQI, USDA, Beltsville, MD 20705) **Hydroxylation of monochloroaniline pesticide residues by *Fusarium oxysporum* Schlecht.** *J. Agric. Food Chem.* 27(5): 1127-1130; 1979 (15 references).

Metabolism of 2-, 3-, and 4-chloroanilines by isolated cultures of the soil fungus *Fusarium oxysporum* Schlecht, and chlorpropham in soil was investigated. Hydroxylated (phenolic) products were detected colorimetrically, extracted, and characterized by thin-layer and gas chromatography and mass spectrometry. The presence of *o*-hydroxylated chloroanilines in *F. oxysporum* culture solutions was established by a characteristic *o*-elimination process which resulted in the formation of chlorinated benzoxazolines during mass spectral analysis of acylated derivatives. 2-Amino-4-chlorophenol and 2-amino-5-chlorophenol were positively identified as metabolites, of 3- and 4-chloroaniline, respectively, in *F. oxysporum* culture solutions by comparison of the mass fragmentation patterns with acylated reference standards. Chloroaminophenols were also detected as metabolites of 2-chloroaniline in *F. oxysporum* culture solutions and from chlorpropham-treated soil. (Author abstract reprinted by permission of the American Chemical Society)

79-2942. Kratzer, R. H.; Paciorek, K. J. L.; Kaufman, J.; Ito, T. I.; Nakahara, J. H. (Ultrasystems Inc., Irvine, CA 92715) **Phospha-*s*-triazines. IV. Degradation studies of 1-diaryl phospha-3,5-bis (perfluoroaliphatic)- 2,4,6,-triazines and 1,3-bis (diarylphospha)- 5-perfluor aliphatic-2,4,5- triazines.** *J. Fluorine Chem.* 13(3): 199-208; 1979 (7 references).

Mono- and diphospha- *s*-triazines were studied at 235 and 316°C using sealed Pyrex ampoules to determine the thermal and thermal oxidative stability. Compounds included in the study were: 1-diphenyl phospha- 3,5-bis (perfluoro- *n*-heptyl) 2,4,6-triazine, 1,diphenyl phosppa-3,5-bis (perfluoroalkyleter) 2,4,5-triazines and their respective pentafluorophenyl analogoues, 1,3-bis(diphenylphospha)- 5-perfluoro- *n*-heptyl-2,4,6-triazine and 1,3-bis(diphenylphospha) -5- perfluoro alkylether-2,4,6-triazine. When the phenyl groups were present on the phosphorus the compound exhibited good thermal stability up to the 316°C mark. At these same temperatures the analogous compounds with pentafluorophenyl substitution showed extensive degradation. At 235°C the oxidative stability of both the mono- and diphospha-*a*-triazines was good. At 316°C some degradation was found. This degradation was more pronounced in compounds containing the perfluoroalkyl moiety on the carbon than in the perfluoroalkylether substituted members of the series.

79-2943. Reinhard, M.; Dolce, C. J.; McCarty, P. L.; Argo, D. G. (Dep. Civ. Eng., Stanford Univ., Stanford, CA) **Trace organics removal by advanced waste treatment.** *J. Environ. Eng. Div. Am. Soc. Civ. Eng.* 105(EE4): 675-693; 1979 (15 references).

The degree to which trace organics were removed from water at an advanced waste treatment plant were investigated. The plant, located in Orange Country CA, used lime treatment for suspended solids and heavy-metal removal, ammonia stripping and breakpoint chlorination for nitrogen removal, recarbonation and filtration, activated-carbon adsorption for organics removal, reverse osmosis for demineralization, and final chlorination for disinfection. COD, PCBs, DDT, BHC, and heptachlor were effectively removed by chemical clarification. A broad range of volatile compounds was removed by ammonia stripping and activated-carbon including naphthalene. A variety of halogenated compounds, mainly trihalomethanes, were discovered in the water following chlorination. These compounds were formed during the chlorination step.

79-2944. Klapow, L. A.; Lewis, R. H. (California State Water Resour. Control Board, Sacramento, CA) **Analysis of toxicity data for California marine water quality standards.** *J. Water Pollut. Control Fed.* 51(8): 2054-2070; 1979 (19 references).

This review covers the literature available concerning the toxicity of various constituents of wastewater to marine life. Emphasis lies on the heavy metals, chlorinated pesticides (including DDT, BHC, chlordane and PCBs, endosulfan) and PCBs, as well as on other pollutants found in the waters today. General procedures used in data selection for both acute and chronic toxicity tests are discussed. Steps which must be taken to develop water quality standards are presented. Consideration is also given to the bioaccumulation of toxic materials such as metals and chlorinated hydrocarbons. The need for effluent limitations and their establishment is considered, along with controls necessary to meet these standards.

79-2945. Nolting, H. G.; Weinmann, W. D. (Fachgrup. Chem. Mittelpruef., Biol. Bundesanst. Land-Forstwirtsch., Braunschweig, BRD) **Analysenmethode zur Bestimmung von Propyzamidrueckstaenden in verschiedenen pflanzlichen Lebensmitteln, Wasser and Boden. [Determination of residues of Propyzamid in various crops, water, and soil.]** *Nachrichtenbl. Pflanzenschutzdienstes (Braunschweig)* 30(9): 137-140; 1978 (11 references) (German).

A gas chromatographic method was developed for the determination of propyzamide residues in crops. The samples are macerated in acetone, extracted in methylene chloride, cleaned up on a florisil column, and estimated by gas-liquid chromatography using an electron capture detec-

tor. In plant samples sprayed with 0.01-0.1 mg/kg AI, recoveries of propyzamide between 84-100% were obtained. The method is sensitive to amounts as low as 0.01 mg/kg.

79-2946. Amore, F. (Illinois State Water Survey, Urbana, IL 61801) **Analysis of soil and sediment to determine potential pesticide contamination of a water supply impoundment.** *NBS (US) Spec. Publ.* 519: 191-203; 1979 (30 references).

Several solvents were evaluated for extraction of all compounds. Maximum extraction efficiency of compounds of interest with minimum extraction of interference compounds was the goal. Aceontrile and acetone best fit the requirements for extraction solvents. Samples analyzed were soil, sediment and water from a watershed in which about 25 pesticides were used. Eleven pesticides were chosen for quantification. The sediment samples contained *p,p'*-DDE ranging from 0 to 0.26 μg/g (mean 0.049). Levels of *p,p'*-DDD (TDE) ranged from 0 to 0.45 μg/g (mean 0.06). Levels of *p,p'*-DDT ranged 0 to 0.02 μg/g with a mean of 0.0055. Soil samples contained *p,p'*-DDE at levels of 0-2.4 μg/g with a mean of 0.27. The soil *p,p'*-DDT content ranged from 0 to 2.3 μg/g with a mean of 0.25 μg/g. Traces of DDD were detected in a few soil samples. Low levels of dieldrin (0.02-0.4 μg/g) and endrin (0.02 to 0.4 μg/g) were also found. None of the pesticides were detected in water.

79-2947. Lillard, D. A. (Dep. Food Sci., Univ. Georgia, Athens, GA 30602) **Preparation of a pesticide-free protein concentrate from pesticide contaminated poultry meat.** *Poult. Sci.* 57(6): 1769-1770; 1978 (8 references).

Protein concentrates which were free of detectable amounts of pesticide residues were made from poultry meats containing 1.51 ppm lindane and 10.30 ppm endrin, 5.6 ppm aldrin and 5.85 ppm DDT, and 0.68 ppm heptachlor and 6.25 ppm dieldrin using an isopropyl alcohol-hexane extraction procedure. The pesticide residues were extracted with the fat using isopropyl alcohol: hexane solvent systems. These concentrates have good functional properties and can be used in emulsion-type meat products. (Author abstract by permission)

79-2948. Cooke, W.; Nickless, G.; Povey, A.; Roberts, D. J. (Dep. Inorg. Chem., Univ. Bristol, Brisol 1TS, England) **Poly-chlorinated biphenyls, poly-chlorinated naphthalenes and polynuclear aromatic hydrocarbons in Severn Estuary (U.K.) sediments.** *Sci. Total Environ.* 13(1): 17-26; 1979 (25 references).

In order to assess pollutant levels, sediment samples were collected along the Severn Estuary in Great Britain. In January 1978 approximately 2.5 kg silt were collected at Aust and Sharpness, and 2 kg coarse sand were collected at Arlingham. The sediments were size-separated and extracted with cyclic steam distillation into hexane. Gas chromatography interfaced with mass spectrometry was used to analyze the samples. Total biphenyl levels ranged from 38.8 to 1120 ppb. Natural biphenyl ranged from 8.79 to 144 ppb. Total naphthalene ranged from 177 to 1143 ppb. Natural naphthalene ranged from 163 to 1021 ppb. Arochlor 1260 ranged from 71 to 2322 ppb. In all cases, the highest concentrations were found in the coal dust layer of the Arlingham sample. No significant ΣDDT levels were observed.

79-2949. McCauley, B. J. (Dep. Microbiol., La Trobe Univ., Bundoora, Victoria 3083, Australia) **Biodegradation of litter in *Eucalyptus pauciflora* communities. II. Fungal succession in fungicide- and insecticide-treated leaves.** *Soil Biol. Biochem.* 11(2): 175-179; 1979 (16 references).

Tree leaves were placed in mesh bags and treated with 0.45% dieldrin, 0.2% DDT, 0.1% benomyl, or 0.6% zineb. Control leaves were also placed in the bags but were untreated. Fungal succession on untreated leaves followed the general pattern of succession on decidous tree leaves. Coelomycetes and Moniliales were found to be the initial colonizing fungal orders. During lates stages of decomposition, the numbers of Coelomycetes decreased and increases in the frequency of *Penicillium* species and Zygomycetes were noted. DDT, dieldrin, and zineb marginally affected succession. The occurrence of most fungal species was severely restricted by benomyl. Benomyl persistance depressed fungal populations for at least 48 wk.

79-2950. La Fleur, K. S. (Dep. Agron. & Soils, Clemson Univ., Clemson, SC 29631) **Sorption of metribuzin by model soils and agronomic soils: rates and equilibria.** *Soil Sci.* 127(1): 51-55; 1979 (12 references).

Model soils were constructed from sand, alumina, kaolinite, illite, and peat. Metribuzin was adsorbed into these soils at rates independent of the concentration of the chemical. For substrates containing organic matter, the adsorption ratios of the amount sorbed to amount applied decreased with increasing concentration of metribuzin. When using inorganic substrates, the metribuzin sorption ratios were independent of time in general. For the agronomic soils the sorption curves were similar to those obtained for peat-containing model soils. The sorption values for the components of composite soils can be used to calculate the sorption values for the composite soils.

79-2951. Freed, V. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR) **Fate in the environment of families of chemicals used as herbicides in forestry: monitoring,**

breakdown, and residues under conditions of use, physical movement, food chain accumulation, and human and environmental safety when applied. In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC): pp. 71-75; 1978.

When a herbicides reaches its target, the four processes that occur are transport and interaction, the environmetal interaction with the boundary of the organisms, transport through the organism, and then the action at the sensitive site. Vapor pressure and water solubility are important variables controlling environmental processes. A vapor pressure of 10^{-5} is measurably volatile. If an organism or the environment are not overloaded, the pesticide will break down by metabolism, or decompose in the environment. The persistence of some chemicals is much reduced in the tropics in this way. The partition coefficients are a fairly useful measure of the propensity of a compound to biomagnify.

79-2952. Meselson, M.; O'Keefe, P.; Baughman, R. (Dep. Biochem. & Mole. Biol., Harvard Univ., Cambridge, MA) **The evaluation of possible health hazards from TCDD in the environment.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC): pp. 91-101; 1978 (9 references).

The methods of extraction and cleanup of samples for the analysis of dioxin are described. A study in which tissues from cattle, grazed on 2,4,5-T treated rangelands and control rangelands, were analyzed is described. The author participated in the study by analyzing 14 test samples and one control sample. Dioxin was found in 11 of the test animals, but not in the control or in samples from a Cambridge, MA market. The four highest values were 12, 20, 24, and 70 pp. There appears to be an association between the use of 2,4,5-T and positive concentrations of TCDD in beef. Milk from 18 women from areas where 2,4,5-T is used was also tested. Four positive samples (1 ppt each) were found. The results of these tests have led to further studies of the compounds. TCDD has been reported to be toxic to rats at levels as low as 5 ppt.

79-2953. Walter, M. F.; Steenhuis, T. S.; Haith, D. A. (Agric. Eng. Dep., Cornell Univ., Ithaca, NY) **Nonpoint source pollution control by soil and water conservation practices.** *Trans. ASAE* 22(4): 834-840; 1979 (40 references).

Soil and water conservation practices (SWCP) are described for different pollution groups, and SWCP effects on water and soil movement are discussed. Pollutants are characterized as strongly adsorbed substances when they are carried on sediment eroded by overland flow. Organic phosphorus, nitrogen, and chlorinated hydrocarbons, including DDT, paraquat and diquat, are generally transported on clay or organic matter particles. Control practices for splash and interrill erosion of strongly adsorbed subsances include minimum tillage, winter cover crops, and sod-based rotation. Moderately absorbed substances are transported by runoff and include: atrazine, GS13529 (terbuthylazine), 2,4-D, 2,4,5-T, picloram, and trifluralin. Terracing, contour strip cropping, sod-based rotations, and minimum tillage can reduce runoff and reduce the quantity of pesticide needed. Pollutants not adsorbed to particles include nitrates, and a possible control method is improved crop cover.

79-2954. Smith, A. E. (Res. Stn., Agric. Canada, Regina, Saskatchewan S4P 3A2, Canada) **Relative persistence of di- and tri- chlorophenoxy alkanoic acid herbicides in Saskatchewan soils.** *Weed Res.* 18(5): 275-279; 1978 (19 references).

The persistence of 2,4-D, 2,4-DB, dichlorprop, 2,4,5-T, and fenoprop (silvex) at the 2 ppm level was studied in the laboratory on three prairie soils at 85% of field capacity and 20°C. Following extraction of the soils with aqueous acetonitrile containing acetic acid, the herbicidal acids remaining were analyzed gas chromatographically. Breakdown was rapid on all soils and the average half-lives for 2,4-D, 2,4-DB, dichloroprop, 2,4,5-T and fenoprop were < 7, < 7, 10, 12 and 12 days, respectively. Degradation on air-dried soils (15% of field capacity) was negligible with over 85% of the applied herbicides being recoverable after incubation periods during which the herbicides remaining in the moist soils accounted for less than 30% of the original treatments. (Author abstract by permission)

79-2955. Hensley, D. L.; Beuerman, D. S. N.; Carpenter, P. L. (Dep. Hortic., Purdue Univ., West Lafayette, IN 47907) **The inactivation of glyphosate by various soils and metal salts.** *Weed Res.* 18(5): 287-291; 1978 (11 references).

A root bioassay was used to determine the effect of various soils, and the chloride salts of Fe^{3+}, Fe^{2+}, Al^{3+}, Ca^{2+}, K^{+} and Ca^{+} on the activity of glyphosate (Round-up). Mineral soils significantly reduced the inhibitory effects of glyphosate on root growth. One muck soil inactivated glyphosate, but another muck soil and bentonite clay had little effect. Soils with the greatest inactivation capabilities had high concentrations of weak acid extractable iron. Glyphosphate inactivation showed no correlation between cation exchange capacity and organic matter of the muck soils. $FeCl_3$, $FeCl_2$, and $AlCl_3$, significantly reduced the activity of glyphosate, and when allowed to stand in solution, combinations of $FeCl_3$ and glyphosate formed a precipiate. $CaCl_2$, KCl and NaCl did not inactivate glyphosate. (Author abstract by permission)

See also 79-2854, 79-2855, 79-2857, 79-2859, 79-2860, 79-2864, 79-2867, 79-2871, 79-2873, 79-2884, 79-2888, 79-2892, 79-2893, 79-2899, 79-2960, 79-2962, 79-2976, 79-2986, 79-3102 *and* 79-3109.

79-2956. McNulty, F. (Author address not given) **Last days of the condor?** *Audobon* 80(2): 53-58, 62, 68, 72-74, 76-78, 82, 86-87; 1978.

An overview of the threat to wild condors of the San Joaquin Valley from the use of pesticides or the disturbance of the environment by hunters or dams is given. In 1950, DDT was sprayed on 150,000 acres of rangeland adjacent to the western borders of the valley. More recently, herbicides have been used extensively on hundreds of acres to control brush and convert native vegetation to pastureland in the valley. Much of the valley is now cultivated for the growth of crops, and the various types of agricultural chemicals used in conjunction with farming often permeate the air and water. The chemical 1080 (sodium monofluoroacetate) is also used on private grounds near places where condors forage. Condors often feed on carcasses containing high levels of pesticides, such as 1080 and strychnine, which are used extensively for rodent control in the San Joaquin Valley. In 1965, the analysis of the corpse of an immature condor showed residues of 18 ppm DDT and 30 ppm DDE in the visceral fat. Residues of 1080 were also found in the digestive tract of the bird. Many efforts that have been made to save the condor populations from the harmful effects of chemical and physical environmental stresses are discussed.

79-2957. Panigrahy, B.; Grumbles, L. C.; Hall, C. F. (Dep. Vet. Microbiol. & Parasitol., Texas A&M Univ., College Station, TX 77843) **Insecticide poisoning in peafowls and lead poisoning in a cockatoo.** *Avian Dis.* 23(3): 760-762; 1979 (4 references).

Two dead and 2 live adult peafowls were presented for analysis when members of the flock to which they belonged became suddenly ill, suffered apparent loss of corrdination and exhibited foamy mouths. Death followed within 24 hr of the onset of these signs, and 12 birds died in a 4 day period. Analysis of their feed showed less than 0.5 ppm arsenic, 5.0 ppm copper and 20 ppb aflatoxin B1, however, these were considered to be within the normal limits. Livers of the dead birds contained 0.234 ppm heptachlor epoxide and 0.173 ppm heptachlor. It was suggested that the cause of death had been insecticide poisoning.

79-2958. Howard, J. K. (Plant Prot. Div., Jealott's Hill Res. Stn., ICI Ltd., Bracknell, Berkshire, England) **A clinical survey of paraquat formulation workers.** *Br. J. Ind. Med.* 36(3): 220-223; 1979 (14 references).

Two groups of paraquat formulation workers were studied for possible harm due to exposure to the insecticide. The first group consisted of workers involved with the solid formulations, while the second group was exposed to liquid formulations. Rashes of the skin, damage to the nails, and epistaxes were found in most workers due to direct contact of skin and mucous membranes with paraquat. No long-term effects on skin, mucous membranes or general health was noted following paraquat exposure over several years among these workers.

79-2959. Sandifer, S. H.; Wilkins, R. T.; Whitlock, N. H.; Virella, G.; Loadholt, C. B.; Leitner, T. C. (Prev. Med. Div., Dep. Family Pract., Med. Univ. South Carolina, Charleston, SC 29403) **Urinary protein excretion in workers exposed to low doses of cadmium.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 129-135; 1979 (11 references).

A group of 39 workers exposed to cadmium was examined; mild renal dysfunction was detected in three of them. In no case was a fully developed tubular proteinuria found. However, moderate increases of total proteinuria, increased lysozymuria and β-2 microglobulinuria with excretion of low molecular weight proteins by SDS-PAGE were noted. It was concluded that the regular exposure of golf course greens-keepers to cadium was not a hazard at either the stages of formulaton or application as judged by renal function assays for proteinuria.

79-2960. White, D. H.; King, K. A.; Mitchell, C. A.; Hill, E. F.; Lamont, T. G. (Patuxent Wildl. Res. Cent., Gulf Coast Field Stn., US Fish & Wildl. Serv., Victoria, TX 77901) **Parathion causes secondary poisoning in a laughing gull breeding colony.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 281-284; 1979 (8 references).

One hundred sixteen dead gull chicks and several dead adults were collected from a breeding colony in Texas. Stomach content analysis of two chicks revealed larval and adult insects. Concurrently, over 100 dead adults were seen in a nearby cotton field in which parathion was applied at the rate of 0.45 kg/acre (1.13 kg/ha). Gastrointestinal tracts, including digesta, of dead and control birds (collected alive) were anlayzed by gas chromatography mass spectrometry. Brain ChE was determined for dead and control birds. Brain ChE in dead adults was inhibited 57-89%. Brains in 4 of 9 dead chicks showed a ChE inhibition of 75-90%. Parathion was not detected in the control bird gastrointestinal tracts; however, in dead animals, residues ranging from 0.02 to 10 ppm were observed.

79-2961. Benes, V. (Srobarova 48, CS-10042 Prague 10, Czechoslovakia) **Residua pesticidu mezinarodne. [International pesticide residues.]** *Cas. Lek. Cesk.* 118(13): 408-410; 1979 (Czech).

The Codex Commission for Pesticide Residues (CCPR), working within the framework of the FAO/WHO program has, since 1963, been engaged in developing pesticide residue standards for agricultural products and foods which are internationally traded. The procedure is

carried out in 10 steps with the aim of soliciting the support of all member states for a proposed standard. Of a total of 43 member states, six are socialist countries; the CSSR has been cooperating with CCPR since 1972. So far 1300 proposals of maximum permissible limits of pesticide residues in agricultural and food products have been processed and 900 of these have already reached the eighth procedural step. Items on the program of the 10th CCPR sesson are reviewed including food classification, calculated theoretical potential intake of residues, codified maximum residue limits, and progress reports on chlordane, DDT, endrin, paraquat and other pesticide residue codifications.

79-2962. Lawton, R. L. (Dep. Surg., Div. Transplant., Sch. Med., Texas Tech. Univ., Lubbock, TX 79430) **Pesticide levels in patients on maintenance dialysis: effect of single dialyses.** *Clin. Toxicol.* 14(3): 277-279; 1979 (5 references).

A net loss of chlorinated pesticide levels was noted in patients undergoing dialysis. The type of dialysis used was the flat board parallel countercurrent flow type. Due to the relatively small amounts of chlorinated pesticides removed, these findings are not made to suggest that dialysis would be successful in the treatment of patients suffering from chlorinated pesticide poisoning. However, it is suggested that the use of absorbents in the dialysis circuit might enhance removal.

79-2963. Skinner, C. S. (Univ. California, Davis, CA) **Development of an animal model for agricultural field re-entry.** *Diss. Abstr. Int. B.* 40(2): 700; 1979.

The dermal toxicity of five commonly used organophosphate insecticides was investigated using a mouse intermittent self-exposure model. Cholinesterase, body weight, food consumption and symptomology were monitored for 3 days pre-exposure and for 4-6 days during exposure to foliar residues. After two 10 hr exposures muzzled mice showed log-linear cholinesterases responses across a wide range of foliar pesticide concentrations. The greatest responses for both emulsifiable concentrate and encapsulated formulatons were found with diazinon, followed by parathion, and then methyl parathion. Guthion and phosdrin produced no significant responses in any of the parameters investigated at levels beyond normal field concentrations. To determine the major sites of dermal absorption of organophosphates in the foliar self-exposure situation, the percutaneous penetration of ^{14}C parathion in the mouse nose, hind foot, testicle and tail skins was measured by recovery of excreted radioactvity relative to an iv dose. Penetration was in the following relative order, iv (1.0), nose (0.8), testicle (0.4), foot (0.3), tail (0.3). The contribution of each zone to absorption of compounds in whole body exposure was estimated from skin penetration and surface area. Similar mice were then treated on the hind feet with these same insecticides as analytical grade in acetone. Toxicity was highest for phosdrin, followed by parathion, methyl parathion, diazinon and guthion. Use of acute data for prediction of intermittent foliar hazard appears inadvisable on the bases of these data. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7917177)

79-2964. Cedeno-Maldonado, A.; Liu, L. C. (Dep. Crop. Prot., Lilia Delgado Puerto Rico Nucl. Cent., Mayaguez, PR) **Effect of photosynthetic inhibitor herbicides on nitrate reductase activity of non-target species.** *J. Agric. Univ. PR* 63(3): 412-414; 1979 (7 references).

Lemna major L. plants were exposed to nutrient solutions containing 1×10^{-5} to 1×10^{-9} *M* concentrations of ametryne, prometryne, diuron, and fluometuron. Fronds were assayed for nitrate reductase activity 2 days after inoculation of the herbicides. For each herbicide there was an optimum concentration at which its influence on enzyme activity was at its maximum. Fluometuron and prometryne, the herbicides producing the highest increases in enzyme activity, were the least inhibitory at the highest concentrations. The triazines (ametryne and prometryne) caused maximum increases in enzyme activity at 10^{-8} *M*, while the ureas were most effective at 5×10^{-7} *M* concentrations.

79-2965. Metry, A. A. (Author address not given) **An overview of residual waste treatment technology.** *J. Environ. Sci.* 22(5): 15-21; 1979.

Methods for the treatment and disposal of industrial residual wastes including pesticides are reviewed. Stringent environmental legislation including the requirements of the Resource Conservation and Recovery Act encouraged the development of proper hazardous waste management practices. Such practices include one or more of the following: recycling; removal of hazardous components; dewatering; conversion of hazardous components through physical, chemical, or biological treatment; and landfills. Generally, pesticide residue treatment and disposal includes chemical treatment and disposal in a secure landfill or residue storage. Sample treatment processes are described, and waste management considerations are summarized.

79-2966. DiPietro, J. A.; Haliburton, J. C. (Univ. Illinois, Urbana-Champaign, IL 61801) **Toxaphene toxicosis in swine.** *J. Am. Vet. Med. Assoc.* 175(5): 452-453; 1979 (1 reference).

A case of accidental toxaphene poisoning in 150 swine is described. The feeder pigs had been sprayed with 10 times the recommended dose (300 ml of 61% toxaphene in 4*l* H_2O) for treatment of a sarcoptic mange. The pigs

showed signs of head pressing, ataxia, depression, lethargy and diarrhea. Three severely affected pigs were taken to a veterinary lab, and upon necropsy, showed cysts on the renal cortex, enlargement of the renal pelvis and ureters, congested cranial lung lobes, and small, yellow firm livers. Histological findings included peribronchial lymphoid follicles, moderate perivascular cuffing in the brain, moderate congestion of the lungs wth peribronchial lymphoid follicles, and extensive interlobular fibrosis of the liver. Other intoxicated pigs were sprayed with warm water, and after 5 days, appeared clinically normal. Toxaphene residues in the brains of the necropsied pigs ranged from 1.7 to 2.3 ppm, and in the adipose tissue, from 0 to 0.37 ppm.

79-2967. Proudfoot, A. T.; Steward, M. S.; Levitt, T.; Widdop, B. (Reg. Poisoning Treat. Cent., Dep. Clin. Chem., Royal Infirm., Edinburgh, England) **Paraquat poisoning: significance of plasma-paraquat concentrations.** *Lancet* 2(8138): 330-332; 1979 (12 references).

Seventy-nine cases of paraquat poisoning in which the time of ingestion was known were investigated. Two were children, while 77 patients were adults. Venous blood samples (10 ml) were collected, and plasma was separated. Plasma paraquat concentrations were determined by gas chromatography in 9 cases, by radioimmunoassay in 40 cases, and by colorimetric methods in 30 cases. The highest mortality (78%) occurred when the formulation ingested was Gramoxone; Weedol caused 9% mortality. Seventy-one patients were seen within 35 hr after ingestion. The paraquat concentration in the first blood sample was related semi-logarithmically to the time from ingestion. The highest concentrations caused death. Persons whose concentrations did not exceed 2.0, 0.6, 0.3, 0.16 and 0.1 mg/l at 4, 6, 10, 16, and 24 hr after ingestion lived. Four patients who did not survive showed plasma concentrations of 2.8 mg/l at 45 hr, 0.39 mg/l at 52 hr, 1.15 mg/l at 57 hr, and 0.47 mg/l at 104 hr. When serial samples were drawn, plasma paraquat concentratons fell rapidly during the first few hr. After 15-20 hr, they declined more slowly.

79-2968. Thirumurthi, S.; Lebrun, P. (Lab. Ecol. Gen. & Exp., Univ. Louvain, Louvain-la-Neuve, Belgium) **Effects of carbofuran and its metabolites on the populations soil protozoa.** *Med. Fac. Landbouwwet. Rijksuniv. Gent.* 43(2): 581-587; 1978 (15 references).

Carbofuran was applied at 1, 2, 5, 10, and 15 kg AI/ha to a grassland soil. These treatments did little harm to the fauna present, mainly amoebae and flagellates. When tested in the laboratory, neither carbofuran nor its metabolites, 3-hydroxy carbofuran and 3-keto carbofuran, harmed soil protozoa when used at concentrations of up to 50 ppm. A decline in populations exposed to carbofuran and the 3-hyrdroxy metabolite at levels of 100 ppm was noted. However, it is noted that when carbofuran is applied in the field, even as a nematicide, it is not used in this high a concentration.

79-2969. Sugaya, H.; Wakatsuki, S. (Hiraga Gen. Hosp., Hiraga, Akita, Japan) **[Results of a nationwide survey on clinical intoxication cases due to agricultural chemicals, 1978.]** *Nippon Noson Igakkai Zasshi (Jpn. J. Rural Med.)* 28(3): 452-453; 1979 (Japanese).

Results of a nation-wide survey of clinical cases of pesticide intoxication were reported for 1978. Of the cases examined from 28 medical facilities, 89 were men and 78 were women. One-hundred thirteen of the cases reported intoxication by pesticides during application. Nine of the cases occurred as accidents, and 28 were suicides. Fifteen of the reported cases resulted in death; 14 of these were suicides (11 using paraquat). The causitive agents of the intoxications reported for 1978 included organophosphates (63), herbicides (20), sulfur (19), organochlorines (8), antibiotics (5), carbamates (4), other pesticides (35), and unidentified pesticides (13). Other information available illustrates that 19 cases were caused by nicotine sulfate, 13 cases by paraquat, 10 cases by fenthion plus edifenphos, and 9 cases by fenitrothion. Ninety-nine cases were considered acute, 54 cases caused skin impairment, and 3 cases, ocular impairment. The number of cases of pesticide poisonings in 1978 showed no decrease from the numbers found in any of the previous 4 yr.

79-2970. Matsushita, T.; Nomura, S.; Wakatsuki, A.; Matsushima, S.; Sugaya, H. (Sch. Hyg., Fac. Med., Kagoshima Univ., Kagoshima, Japan) **[Actual state of occurrence of skin impairment due to agricultural chemicals in Japan.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Soc. Rural Med.)* 28(3): 454-455; 1979 (Japanese).

Skin impairment due to agricultural pesticides was investigated in 205 men and 181 women over a 5 yr period beginning in 1972. Males were usually in their 50's and females in their 40's. Seasonal occurrences were greatest from May to August. In order of decreasing toxicity, organophosphates, sulfur derivatives, captafol, carbamates, copper derivatives, diphenyl ethers, and organochlorines were found to cause the greatest reactions. Predispositon to allergic reactions was correlated to dietary and respiratory contact. In 67% of the cases exposure was due to application and 31% was due to use other than application. The regions affected were mainly the face, fingers, forearms, neck and legs. The major causes of impairment were related to insufficient protection during use, poor health at time of use and carelessness.

79-2971. Shiaku, K.; Torii, M.; Hirai, K. (Sch. Parasitol., Fac. Med., Ehime Univ., Matsuyama, Ehime,

Japan) **[Results of survey on health impairment due to application of pesticides in citrus culturing district in Ehime prefecture.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Soc. Rural Med.)* 28(3): 456-457; 1979 (Japanese).

Results of survey on the health impairment due to pesticide application in farmers of 44 homes in a citrus cultivating district from May to July, 1978 are reported. The main subjective symptoms were general malaise, skin itching, severe diaphoresis, skin redness, eye itching, loss of appetite and head ache. Pesticides causing severe skin impairment were mancozeb, maneb, dithianon, and chlorfenethol + quinomethionate. Incomplete protection, especially the lack of masks and goggles, was noted. Occurrence of health impairment was more frequent in persons preparing the pesticides and in those holding the nozzle of the sprayer.

79-2972. Ando, M.; Adachi, S.; Taya, T.; Tamura, K. (Tsuchiura Kyodo Hosp., Tsuchiura, Ibaraki, Japan) **[On the aerial concentration of pesticdes and the amount of exposure of the person who has engaged in the pesticide application.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Soc. Rural Med.)* 28(3): 462-463; 1979 (Japanese).

The amount of exposure to a pesticide applicator (a driver of a speed sprayer) of the applied pesticide (1000 times diluted wettable powder of 40% fenitrothion) was investigated by the amount of sediment on the clothes after application. It was found that the hood of the speed sprayer was remarkably effective in preventing exposure. Amounts of pesticide intake by respiration were in proportion to the amount of sedimentation on the clothes. The amount of intake by respiration was very large in the driver of the hooded speed sprayer probably due to the use of a small fan for cooling under the hood. Concentrations of the pesticide in orchards were investigated with a finding that 30 min after of application, finer particles (< 2.1 μm) were still drifting in air. These particles have the highest possibility of human respiratory exposure. Concentrations in a farmhouse near the orchard were also investigated. More than 90% of the particles in the house atmosphere were smaller in diameter than 1 μm.

79-2973. Miura, O.; Sasaki, S.; Kagaya, S.; Watabe, K.; Sugaya, H. (Hiraga Gen. Hosp., Hiraga, Akita, Japan) **[Concentration of paraquat in the organs, blood and urine of the dead persons due to intoxication by paraquat in 1978.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Soc. Rural Med.)* 28(3): 470-471; 1979 (1 reference) (Japanese).

Concentrations of paraquat in the organs, blood and urine of three people who died after paraquat ingestion and the course of their intoxication history are reported. In the case of a 39-yr-old woman, who swallowed 80-100 ml of a 24% paraquat preparation in a suicide attempt and died 21 hr later, pulmonary edema and acute renal failure were noted. Concentrations of paraquat (in μg/g organ weight) were: 35.09 in the lung, 41.25 in the kidney, 15.28 in the spleen, 18.57 in the liver, and 234.38 in the urine. In the serum only trace amounts were found and concentrations in the content of the stomach was 5.19. In the case of a 25-yr-old man who swallowed 50 ml of a 24% preparation in a suicide attempt, death occurred 20 hr later due to acute renal failure. The concentrations of paraquat (in μg/g organ weight) were: 92.11 in the lung, 37.86 in the kidney, 61.40 in the liver, 1.75 in the omental fat, 862.50 in the urine, 4.50 in the blood at 19 hr after ingestion and 7.81 in blood at autopsy, 65.00 in the sputum and 17.50 in the contents of the stomach. In the third patient, non-detectable or trace levels of paraquat were found in the body at autopsy. The first two cases are suggested to be representative paraquat poisoning cases.

79-2974. Masumitsu, T.; Nagata, J.; Kobayashi, S.; Ono, T. (Hokushin Gen. Hosp., Nakano, Nagano, Japan) **[Studies on intoxication due to nicotine. First report.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Soc. Rural Med.)* 28(3): 458-459; 1979 (Japanese).

Results of analyses on 61 cases of nicotine intoxication over a 12 yr period beginning in 1966 are reported. Percent nicotine intoxication of the total pesticide intoxication cases in the period was as high as 25%; no cases of death due to nicotine were reported. The occurrences of intoxications were concentrated in July and August, usually in persons in their 30's. The number of patients intoxicated by the combined use of nicotine and Bordeaux mixture was 3 times higher than in those using only nicotine. The major symptoms of nicotine intoxication were vomiting, nausea, headache, dizziness, loss of appetite and malaise. Symptoms mainly appeared 1-6 hr after application of the pesticide. An increased sensitivity of non-smokers to nicotine is suggested. The causes of intoxication were considered to be the length of application, high temperatures on the day of application and the lack of protective equipment on the face and hands.

79-2975. Ohkubo, T.; Takeda, K.; Okano, T.; Shigeizumi, Y.; Oikawa, M.; Toyohara, T.; Hayashi, S.; Hirata, M.; Komatsuda, H.; Sugaya, H.; Sasaki, S.; Watanuki, T. (Dep. Internal Med. 1, Hiraga Gen. Hosp. Hiraga, Akita, Japan) **[A case of death due to paraquat intoxication.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Soc. Rural Med.)* 28(3): 472-473; 1979 (Japanese).

A 32-yr-old man, while under the influence of alcohol, accidentally ingested a small amount of paraquat (24% solution diluted 60 times). The patient was examined 6 days later and complained of oliguria. Ulcers and erosions in the oral cavity and slight jaundice in the ocular conjunctiva were noted upon hospitalization. Urine paraquat concentrations were 1300 ml on the day of hospitalization. Peritoneal perfusion was performed on days 7-9 of intoxication and large doses of adrenal cortical hormone

were administered. Paraquat in the urine was detected up to day 32. Transient edema was noted on days 14-23. Dyspnea and cynosis increased from the 18th day, even though he was kept under an oxygen tent. The patient died on day 102 from respiratory failure. Findings at autopsy were: severe and remarkable pulmonary fibrosis in the lower lobes of the lungs with secondary infection, pulmonary emphysema in the upper lobes; congestion and fatty degeneration in the liver; and multiple ulcers in the stomach. The residual amount of paraquat in the organs was very small. The development of pulmonary fibrosis was thought to be affected by secondary factors.

79-2976. Kutz, F. W. (Ecol. Monit. Branch, US EPA Washington, DC 20460) **Human and environmental monitoring for herbicides used in forestry.** In: *Symposium on the Use of Herbicides in Forestry.* (USDA: Washington, DC): pp. 83-90; 1978.

Different monitoring programs for the detection of levels of herbicides used in forestry are discussed and the risk of these chemicals to the environment and the human population is explored. The Ecological Monitoring Branch of the EPA has programs to sample air, soil, surface water, estuarine organisms, and human tissue, and analyze them for pesticide residues. The National Human Monitoring Program determines the incidence and extent of exposure of all persons to pesticides. Of the 7500 samples proposed for analysis, 400 have been analyzed. The frequency of 2,4-D, 2,4,5-T, and silvex residues in these human samples has been extremely low. The air monitoring program in 1970, 1971 and 1972 detected a number of 2,4-D and 2,4,5-T esters, indicating the probable risk of human exposure to airborne pesticides. The National Surface Water Monitoring Program has detected residues of 2,4-D as high as 1.91 ppb and residues of 2,4,5-T as high as 0.85 ppb. A panel discussion of the paper concentrates on the risk of TCDD contamination in forestry-use herbicides. Re-entry guidelines as well as improved residue detection methods are discussed with respect to prevention of human toxicity and environmental contamination.

79-2977. Fairshter, R. D.; Dabir-Vaziri, N.; Smith, W. R.; Glauser, F. L.; Wilson, A. F. (Dep. Med., Irvine Med. Cent., Univ. California, Orange, CA 92668) **Paraquat poisoning: an analytical toxicologic study of three cases.** *Toxicology* 12(3): 259-266; 1979 (32 references).

Case histories of three persons exposed to paraquat are presented. The first, a 17-yr-old male, accidentally ingested a mouthful of 29% paraquat. The second, a 16-yr-old male, purposefully ingested a mouthful of 29% paraquat. The third patient, a 56-yr-old male, also purposefully ingested a large cup of 29% paraquat. The first two patients died 22 and 23 days after ingestion, respectively, from severe pulmonary fibrosis. The third patient died 16.5 hr after ingestion from severe pulmonary edema with areas of hemorrhage and hyaline membrane formation. In the first two cases paraquat was found in the liver, kidney, lung, heart, spleen, brain, and in the adipose tissue. In the third patient paraquat, generally at much higher concentrations, was found in the lung, fat, heart, muscle, spleen, liver, brain and kidney; the kidney had the highest concentration. In each case, during treatment within hours of ingestion, paraquat could be removed by both hemodialysis and forced diuresis; hemodialysis was found to be more effective. At 24 hr post-ingestion very little paraquat could be removed by either hemodialysis or by forced diuresis.

79-2978. Halliwell, W. H. (Elars Biores. Lab., Fort Collins, CO) **Diseases of birds of prey.** *Vet. Clin. North Am. Small Animal Pract.* 9(3): 541-568; 1979 (8 references).

Veterinary diseases of raptors are reviewed. Although not common patients, captive birds of prey are being seen by more veterinarians, due to the fact that their declining populations are becoming an environmental issue and because falconeering is still a practiced sport. The emphasis of the article is on noting any clinical or anatomical abnormalities as a result of physical and biochemical examinations. Chemical contamination of the environment, by DDT, DDE, PCBs, dieldrin and other toxic products, has increased the level of residues of these chemicals in the body fat depots. These residues have been found to be a major cause of reproductive failure in these birds. Metabolic disorders have also been recognized to be results of pesticidal contamination. Clinical toxicity appears in the birds when these residues are redistributed throughout the body to other areas, particularly in the fat-rich nervous system. Other diseases, caused by bacteria, fungi, viruses and nutritional deficiencies, are also discussed.

79-2979. Schmid, O. (Med. Forsch. Abt., Chem. Fabr. Stockhausen & Cie., D-4150 Krefeld, BRD) **Dermale (perkutane) Toxizitaet von Arbeitsstoffen. [Dermal (percutaneous) toxicity of work materials.]** *Zentralbl. Arbeitsmed. Arbeitsschutz Prophylaxe* 29(6): 145-149; 1979 (13 references) (German).

LD50s and acute dermal toxicities of hazardous substances, as determined by methods listed in the US Federal Hazardous Substances Labeling Act of 1961, are presented. Substances, originally listed in the Registry of Toxic Effects of Chemical Substances, which can potentially be resorbed by the skin are tabulated. Indication of the dermal(Ka) LD10, dermal(Ra) LD50, dermal(Hmn) LD10 and oral LD50, are given for 61 of these substances. Another 41 chemicals are also presented but no dermal toxicity data are given. The dermal toxicities of these 41 compounds can be estimated from their oral toxicities but such estimates can be unreliable. It is suggested that an 8 wk percutaneous screening test be performed on hairy mice so that more accurate indications of the dermal toxicities of these compounds can be made available.

See also 79-2853, 79-2854, 79-2862, 79-2865, 79-2866, 79-2871, 79-2876, 79-2877, 79-2878, 79-2879, 79-2880, 79-2884, 79-2886, 79-2887, 79-2902, 79-2922, 79-2924, 79-2937, 79-2951, 79-3044 *and* 79-3074.

79-2980. Miyamoto, J.; Takimoto, Y.; Mihara, K. (Res. Dep., Pestic. Div., Inst. Biol. Sci., Sumitomo Chem. Co. Ltd., Hyogo 665, Japan) **Metabolism of organophosphorus insecticides in aquatic organisms, with special emphasis on fenitrothion.** *ACS Symp. Ser.* 99(Ch. 1): 3-20; 1979 (18 references).

Metabolism and bioaccumulaton of fenitrothion were studied in several aquatic species under laboratory conditions. Both *in vitro* and *in vivo* studies were made. Rainbow trout were able to metabolize the compound *in vivo* through oxidative desulfuration, cleavage of the P-O-aryl linkage, and O-demethylaton. Parent compound and degradation products are excreted into the water. Bioaccumulation, as a result, was not greatly increased in the fish species. Carp tissues were shown under a static model ecosystem to contain several amino derivatives of the insecticide along with several nitro-containing compounds. Carp, snails, daphniids and algae showed decreasing concentrations of the insecticide with the passage of time. However, snails, daphniids and algae in general showed an increase in the bioaccumulation relative to the concentration in the water, which was assumed to be due to the lower metabolic activity, along with the possible influence of a slow excretion rate.

79-2981. Khan, M. A. Q.; Feroz, M.; Sudershan, P. (Dep. Biol. Sci., Univ. Illinois, Chicago, IL 60680) **Metabolism of cyclodiene insecticides by fish.** *ACS Symp. Ser.* 99(Ch. 3): 37-56; 1979 (25 references).

When exposed to *cis*-chlordane under similar conditions, bluegill absorbed the chemical at a higher rate than did the amphibian, *Xenopus laevis.* Bluegill and goldfish absorbed photo- *cis*-chlordane at a higher rate than *cis*-chlordane. Fish also eliminated photo- *cis*-chlorane faster than they did *cis*-cholordane. Cichlid, bluegill and goldfish metabolized *cis*-chlordane very slowly. Bluegill and goldfish efficiently metabolized photo-*cis*-chlordane and heptachlor, respectively. Dichlorochlordene and oxychlordane were metabolites formed by cichlids from *cis*-chlordane. Fish metabolites commonly included chlordene chlorohydrin and hydroxylated products. Hepatachlor epoxide, 1-hydroxy 2,3-epoxychlordene, 1-hydroxychlordene, hepatachlor diol and trihydroxy hepatachlor-conjugate were formed by the metabolism of heptachlor. Bluegill slowly metabolized photodieldrn and the products from the metabolism suggest the presence of photodieldrin ketone and hydroxylated compounds.

79-2982. Lay, M. M.; Niland, A. M.; Debaun, J. R.; Menn, J. J.; Tseng, C. K. (Mountain View Res. Cent., Stauffer Chem. Co., Mountain View, CA 94042) **Metaboolism of the thiocarbamate herbicide molinate (Ordram) in Japanese carp.** *ACS Symp. Ser.* 99(Ch. 6): 95-119; 1979 (19 references).

Japanese carp were exposed to ^{14}C-labeled molinate at a concentration of 0.2 ppm. Fish were analyzed at 1, 4, 7, and 14 days after exposure. An average bioaccumulation of 1.35% was recorded during the 14 day exposure. The chemical disappeared rapidly from the water, accounting for only 3.8% of the extracted radiocarbon in the water on the 14th day. Various organosoluble and water soluble degradation products were formed readily on addition of the molinate to the water. Some of the metabolites found in the water or in the fish bile included molinate sulfoxide, ring-hydroxylated molinate, isomers of keto molinate, keto hexamethylene imine (HMI), and hexamethylene imine. Carp liver microsomal mixed-function oxidase systems during *in vitro* studies produced the same organosoluble metabolites found in the water containing live fish. It is suggested that the metabolic pathway studied herein involved sulfoxidation, oxidation to both hydroxy and keto derivatives, and possible conjugation involving carbamoylation of endogenous SH-groups and O-conjugation of HMI.

79-2983. Allen, J. L.; Dawson, V. K.; Hunn, J. B. (Natl. Fish. Res. Lab., US Fish & Wildl. Serv., La Crosse, WI 54601) **Biotransformaton of selected chemicals by fish.** *ACS Symp. Ser.* 99(Ch. 7): 121-129; 1979 (36 references).

A review is presented of some of the metabolic pathways used by freshwater fish in the biotransformation of selected chemicals. Glucuronide conjugation has been exhibited in rainbow trout exposed to the lampricides TFM (3-trifluoromethyl 4-nitrophenol) or Bayer 73 (aminoethanol salt of 2′,5- dichloro-4′-nitrosalicylanilide). Ester hydrolyzed products are reported in several species of fish exposed to anesthetics. Besides being metabolized by ester hydrolysis, the fish anesthetic M-222 was also found to undergo acetylation in fish in both *in vivo* and *in vitro* studies. Carp have been shown to biotransform the herbicide dinitroamine by *N*-dealkylation. *S*-methylation of the insecticide isobornyl thiocyanoacetate (Thanite) has also been noted in fish.

79-2984. Kobayashi, K. (Lab. Fish. Chem., Fac. Agric., Kyushu Univ., Fukuoka, Japan) **Metabolism of pentachlorophenol in fish.** *ACS Symp. Ser.* 99(Ch. 8): 131-143; 1979 (15 references).

A possible relationship between the toxicity and accumulation of chlorophenols in goldfish was considered. Previous studies had shown that an increase of the chlorine atom number in the chlorophenols causes an abrupt increase in toxicity. Similarly, an increase in the number of chlorine atoms promoted an accumulation of the chlorophenols by fish and led to the concentration of these chemicals in the fish to lethal levels. Specific factors considered in the article include the absorption of PCP, biliary excretion of PCP-glucuronide, excretion of PCP-sulfate into surrounding water, renal excretion of PCP-sulfate, major detoxification pathways for PCP, and the effect of

pre-exposure to PCP on PCP-tolerance and sulfate conjugation activity.

79-2985. Yarbrough, J. D.; Chambers, J. E. (Dep. Biol. Sci., Mississippi State Univ., Mississippi State, MS 93762) **The disposition and biotransformation of organochlorine insecticides in insecticide-resistant and -susceptible mosquitofish.** *ACS Symp. Ser.* 99(Ch. 9): 145-159; 1979 (21 references).

Both resistant and susceptible populations of *Gambusia affinis* were exposed to DDT, aldrin, dieldrin, endrin, and toxaphene. The resistant population demonstrated a 5 to 500 fold resistance to these organochlorine insecticides over the susceptible populations. The individuals in the susceptible group experienced a greater accumulation of insecticide in the tissues than did those of the resistant group. It was noted, however, that resistant fish accumulated far greater body loads of insecticide without giving evidence of toxicity than did the susceptible fish. Seasonal trends were noted among the hepatic mixed-function oxidase activities in both populations. The liver size was larger in the resistant fish, allowing a greater potential for xenobiotic metabolism. It was suggested that biotransformation was only a minor significance in chlorinated alicyclic insecticide resistance in mosquitofish. Of greater importance were barriers to penetration. The most important factor in resistance apparently was an implied target site insensitivity.

79-2986. Schooley, D. A.; Quistad, G. B. (Biochem. Dep., Zoecon Corp., Palo Alto, CA 94304) **Metabolism of insect growth regulators in aquatic organisms.** *ACS Symp. Ser.* 99(Ch. 10): 161-176; 1979 (42 references).

The degradation of various insect growth regulators in aquatic systems is discussed including studies conducted on diflubenzuron, R-20458, epifenonane and methoprene. In each case a discussion of hydrolysis, photodegradation and degradation by soil microorganisms is considered. Specific studies dealing with these chemicals in the aquatic ecosystem and fish are reviewed. While these chemicals represent different structural types, each is degraded quickly in the aquatic environment.

79-2987. Zitko, V. (Fish. & Environ. Sci., Biol. Stn., Fish. & Oceans Canada, St. Andrews, New Brunswick E0G 2X0, Canada) **The fate of highly brominated aromatic hydrocarbons in fish.** *ACS Symp. Ser.* 99(Ch. 11): 177-182; 1979 (11 references).

Fish were exposed to highly brominated aromatic hydrocarbons for periods of 48 hr. The compounds used in the study included *p,p'*-DDT, dieldrin, 2,4,',5-tribromobiphenyl, 1,2,4,5-tetra bromobenzene, hexachlorobenzene, 1,3,5-tribromobenzene, 1,2,4-tribomobenzene, 2,5-dibromoxylene, and 2,5-dibromotoluene. These compounds were not greatly accumulated in the fish perhaps due to low water solubility and also to low membrane permeability. A method for measuring transport rates is described.

79-2988. Isensee, A. R.; Kearney, P. C.; Jones, G. E. (Pestic. Degrad. Lab., Environ. Qual. Inst., USDA, Beltsville, MD 20705) **Modeling aquatic ecosystems for metabolic studies.** *ACS Symp. Ser.* 99(Ch. 13): 195-216; 1979 (10 references).

Matapeake silt loam (14 kg) was treated with ^{14}C-trifluralin (10 ppm) and flooded with 84*l* of water to demonstrate the feasibility of construction of a static water model ecosystem of sufficient size to study the kinetics of pesticides. For a 72 day period, bluegill fish, snails, daphnids, and algae were exposed to this model system. Water samples were analyzed at 2, 5, 9, 15, 22, 30, 43, 48, and 58 days after the start of exposure for ^{14}C activity by liquid scintillation counting. Soil samples were analyzed by scintillation counting and TLC after being removed from the tanks on days 2, 5, 9, 15, 27, 30, 43, 58, and 72. Tissues of exposed organisms were also sampled at various intervals and were analyzed for residues of trifluralin and its metabolites. Trifluralin was degraded in both water and soil sediments. Residues of trifluralin metabolites in the biomass were derived preimarily through absorption from water, rather than through organism metabolism of trifluralin. These results suggest that the ecosystem model should be used in studies of system processes rather than in processes that function in individual components of the environment.

79-2989. Crosby, D. G.; Landrum, P. E.; Fischer, C. C. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616) **Investigation of xenobiotic metabolism in intact aquatic animals.** *ACS Symp. Ser.* 99(Ch. 14): 217-231; 1979 (21 references).

Reasons are given for the lack of information concerning the metabolism of environmental contaminants in aquatic species. Principal experimental systems used to gather such information in laboratory species such as rats are compared to procedures necessary to gather similar information on aquatic species. The aquatic echinoderm and the terrestrial mammal each deal with chemicals via different metabolic pathways. Specific attention is given in the review to laboratory metabolism chamgers, aquatic metabolism protocol, *p*-nitroanisole pharmacodynamics in the sea urchin, and *p*-nitroanisole metabolism.

79-2990. Guarino, A. M.; Arnold, S. T. (Lab. Toxicol., NCI, NIH, Bethesda, MD 20014) **Xenobiotic transport mechanisms and pharmacokinetics in the dogfish shark.** *ACS Symp. Ser.* 99(Ch. 15): 233-258; 1979 (34 references).

The disposition and pharmacokinetics of various compounds in the dogfish shark were considered. Among the compounds used were DDT and dieldrin. Concentrations of these pesticides found in the plasma, liver, bile, kidney, urine, muscle, brain, and CSF of the shark are reported. Various pharmacokinetic parameters were also studied. It was noted that the shark proved to be a very worthwhile animal to study and yielded information which in some cases was not available from other animals. The transport parameters in this fish were found to be similar to those found in mammals. It is suggested that the dogfish shark be used as a model to study aquatic pollutants.

79-2991. Krieger, R. I.; Gee, S. J.; Lim, L. O.; Ross, J. H.; Wilson, A.; Alpers, C.; Wellings, S. R. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616) **Disposition of toxic substances in mussels (*Mytilus californianus*): preliminary metabolic and histologic studies.** *ACS Symp. Ser.* 99(Ch. 16): 259-277; 1979 (31 references).

Mussels (*Mytilus californianus*) were exposed to aldrin by injection into the posterior adductor muscle or through slow release from a syringe directly onto viscera for *in vivo* studies. Tissue homogenates were later analyzed for aldrin and dieldrin. Uptake and elimination studies were performed in mussels using antipyrine. The usefulness of these studies is the possiblity that they will allow the assessment of certain biological consequences of environmental stress. The effect of aldrin, *p*-nitroanisole, and SKF 525A on the uptake and elimination of antipyrine by mussels was also examined. Histopathological studies were performed on the mussels for the purpose of detecting changes in tissue, and cellular form and function which could be associated with stress. Biochemical studies using cell-free preparations of mussel tissue homogenates also proved useful in assessing the effects of pollutants on these organisms.

79-2992. Ahokas, J. T. (Clin. Pharmacol. Unit, Dep. Med., Princess Alexandria Hosp., Brisbane, Australia) **Cytochrome P-450 in fish liver microsomes and carcinogen activation.** *ACS Symp. Ser.* 99(Ch. 17): 279-296; 1979 (74 references).

The existence of multiple forms of cytochrome P450 in fish is considered. The inhibition of monooxygenase activity in fish and mammalian hepatic microsomes by various compounds is discussed. Included among these compounds are SKF 525A, metyrapone, DDT, pyridine, *n*-octylamine, α-naphthoflavone, lindane, and testosterone. The role of cytochrome P450 in carcinogen metabolism is discussed. While several reports indicate that fish liver microsomes can activate promutagens into mutagenic intermediates, there is a lack of a unified picture. This lack of unity has apparently arisen from the use of various species of fish. It is urged that efforts be made to characterize cytochrome P450 mediated aryl hydrocarbon hydroxylase and carcinogenesis in one population of fish so that conclusive results can be obtained on inducibility, carcinogen activation, and somatic mutation.

79-2993. Estenik, J. F.; Collins, W. J. (Dep. Zool., Ohio State Univ., Columbus, OH 43210) ***In vivo* and *in vitro* studies of mixed-function oxidase in an aquatic insect, *Chironomus riparius*.** *ACS Symp. Ser.* 99(Ch. 21): 349-370; 1979 (44 references).

Midge larvae were collected and reared to the adult stage. Various insecticides, including *p,p'*-DDT, lindane, parathion, paraoxon, malathion, malaoxon, propoxur, carbaryl, Landrin, aminocarb, mexacarbate, allethrin, piperonyl butoxide, sesamex, aldrin, and dieldrin were used in tests with the insects. *Chironomus riparius* larvae were susceptible to insecticides in μg/*l* concentrations. Aldrin and dieldrin were rapidly accumulated by midge larvae and these were also readily epoxidized without further conversion. The optimum conditions for *in vitro* epoxidase activity of midges were typical of those for other insects. It is suggested that midge preparations be used as a convenient and effective tool for the study of insect mixed function oxidases.

79-2994. Loi, N. P. (Inst. Chem. Plant Subst., Tashkent, USSR) **Izmenenie soderzhaniia svobodnykh i cviazannykh aminokislot v rasteniiakh pod vliianiem gerbitsida KhIB. [Changes in the content of free and bound amino acids in plants after treatment with herbicide CIB.]** *Agrochemia* 18(5): 105-108; 1979 (13 references) (Russian).

An attempt was made to evaluate the effect of herbicidal and nonherbicidal concentrations of 1-isopropenyl-5-chlorobenzo imidazolone (CIB) on protein metabolism in bean plants that are sensitive to this herbicide. Bean plants at the 2-leaf stage were exposed to 10^{-3} and 10^{-5} *M* solutions of CIB for 8 hr. The level of free and bound amino acids in leaves was determined on day 2 after the treatment. It was found that at herbicidal concentration (10^{-3}*M*), CIB inhibited the protein synthesis in bean leaves, causing marked decrease of the level of all bound amino acids. The decrease of the level of bound amino acids was due to the decrease in the level of free amino acids. Treatment with CIB (at herbicidal concentrations) also increased the accumulationof free ammonia in bean leaves (the level of free ammonia in treated leaves was 1.8 times greater than in control leaves). CIB at nonherbicidal concentrations (10^{-5}*M*) enhanced protein synthesis causing a significant increase in the level of all free amino acids, with simultaneious increase in the levels of all bound amino acids.

79-2995. Greenlaw, C. W. (Dep. Pharm. Serv., Holy Cross Hosp., Ft. Lauderdale, FL 33308) **Drug interaction**

between co-trimoxazole and warfarin. *Am. J. Hosp. Pharm.* 36(9): 1155-1156; 1979 (5 references).

A 71-yr-old woman was diagnosed with a cerebral vascular accident and left hemiparesis. She had been taking the following medications: propranolol (20 mg three times/day), hydralazine and hydrochloro thiazide (25 mg each/day), Triavil 2/25 once daily and warfarin (5 mg/day). It was found that co-trimoxazole had enhanced the hypoprothrombinemic effects of warfarin. It is suggested that an inhibition of the metabolism of warfarin took place along with plasma protein displacement.

79-2996. Crozet, N.; Szollosi, D. (Stn. Cent. Physiol. Anim., INRA, F-78350 Jouy en Josas, France) **The effects of isopropyl-*N*- phenylcarbamate on meiotic maturation of mammalian oocytes.** *Ann. Biol. Anim. Biochim. Biophys.* 19(4A): 1131-1140; 1979 (19 references).

Mouse and rabbit oocytes were exposed to culture media containing 2 x 10^{-4} *M* isopropyl- *N*-phenylcarbamate (IPC, propham), an herbicide of antimitotic capacity. The normal *in vitro* meiotic maturation of the oocytes was inhibited by the herbicide by preventing the formation of cytoplasmic microtubules. IPC applied at or before the onset of oocyte maturation also induces disturbances in the orientation of forming microtubules of the metaphase I spindle, and, in the mouse oocyte, causes an increase in the numbers of nuclear bodies. The changes in the number of nuclear bodies and their continuity with other nuclear structures may be expressions of modifications occurring either in the production or processing of RNA products.

79-2997. Matthews, H. B.; Kato, S. (Lab. Pharmacol., Natl. Inst. Environ. Health, Research Triangle Park, NC 27709) **The metabolism and disposition of halogenated aromatics.** *Ann. NY Acad. Sci.* 320: 131-137; 1979 (38 references).

Certain halogenated aromatics contain a polar moiety which facilitates their excretion as the parent compound, or conjugates of the parent compound. The hydrophilic moiety of chloriated phenoxy herbicides is the organic acid. Compounds such as 2,4,D, 2,4,5-T, and silvex are readily absorbed from the intestine. Kepone (chlordecone) and mirex, which contain perchlorinated polycyclic carbon cage structures, illustrate the effect that a single substitution may have on the disposition of a halogenated xenobiotic. Mirex is concentrated in the adipose tissue and skin. Kepone, being much more polar than mirex, concentrates in the liver, and to a lesser extent, in the adipose tissue.

79-2998. McConnell, E. E.; Moore, J. A. (Environ. Biol. & Chem. Branch, Natl. Inst. Environ. Health Sci., Research Triangle Park, NC 27709) **Toxicopathology characteristics of the halogenated aromatics.** *Ann. NY Acad. Sci.* 320: 138-150; 1979 (58 references).

This review discusses the characteristics of the halogenated aromatics pertaining to their toxicopathology. Attention is given to clinical syndromes, postmortem and histopathologic observations in experimental organisms, and clinical chemistry. Among the chemicals mentioned in the review are dibenzo- *p*-dioxin (TCDD), biphenyl, dibenzofuran, and naphthalene.

79-2999. Skalsky, H. L.; Fariss, M. W.; Blanke, R. V.; Guzelian, P. S. (Dep. Pharmacol., Med. Coll. Virginia, Richmond, VA 23298) **The role of plasma proteins in the transport and distribution of chlordecone (Kepone) and other polyhalogenated hydrocarbons.** *Ann. NY Acad. Sci.* 320: 231-237; 1979 (32 references).

Serum proteins taken from a patient 6 mo after the last exposure to chlordecone were separated by gel filtration chromatogrpahy. The major portion of the eluted chlordecone was associated with the first of the three protein peaks. After a 12 mo period the levels of chlordecone in the adipise tissue and in the blood of the patient had declined, although the concentration in the tissue was still 7 times greater than that in the blood. It is suggested that chylomicrons may be of lesser importance than other lipoproteins in binding chlordecone. The binding of chlordecone to the proteins in the first peak involves slowly reversible interactions.

79-3000. Hansen, L. G. (Coll. Vet. Med., Univ. Illinois, Urbana, IL 61801) **Selective accumulation and depletion of polychlorinated biphenyl components: food animal implications.** *Ann. NY Acad. Sci.* 320: 239-246; 1979 (32 references).

Various factors are involved in the selective accumulation of PCB components in adipose tissues. Absorption, metabolism, distribution, and excretion all vary within the same species and between species of test animals. The nutritional state of the experimental animal is also a significant factor in chlorinated hydrocarbon clearance. HCB (hexachlorobenzene) stored in fatty tissue is mobilized during periods of food restriction. The size of the adipose compartment available to chlorinated hydrocarbon storage is also a factor, as is evidenced by experiments comparing swine to other domestic species with smaller proportions of body fat. Also, different species have available to them different means of excretion. For example, the laying chicken can rid her body of foreign chemicals in the egg yolks, whereas the swine cannot.

79-3001. Brimfield, A. A.; Street, J. C. (Interdep. Program Toxicol., Utah State Univ., Logan, UT 84322)

Mammalian biotransformation of chlordane: *in vivo* and primary hepatic comparisons. *Ann. NY Acad. Sci.* 320: 247-256; 1979 (23 references).

In this discussion of the metabolism of chlordane, emphasis is given to the production of oxychlordane. A hypothetical pattern for overall metabolism of the chemical is presented. Pathways other than desaturation and epoxide production are also considered. Findings from *in vivo* and *in vitro* experimentation are presented and compared.

79-3002. Vos, J. G.; van Logten, M. J.; Kreeftenberg, J. G.; Kruizinga, W. (Natl. Inst. Public Health, Bilthoven, The Netherlands) **Hexachlorobenzene-induced stimulation of the humoral immune response in rats.** *Ann. NY Acad. Sci.* 320: 535-550; 1979 (19 references).

Wistar rats were fed diets containing 0, 500, 1000, or 2000 mg HCB (hexachlorobenzene)/kg. The spleen, popliteal and mesenteric lymph nodes, and liver showed marked weight increases. The white pulp in the spleen was enlarged. An increase of extramedullary hemopoiesis was also noted. Total serum IgM levels were increased, but IgG was unchanged. The results of the current study differ from literature data which show that HCB suppresses the humoral and cell-mediated immunity in mice. HCB pretreatment only slightly increased the susceptibility of rats to endotoxin. It was concluded that HCB stimulated the humoral immune response in the rat, and enhanced the *in vitro* responsiveness of spleen cells to the different mitogens mainly as a result of an increase in the number of splenic lymphocytes, but did not change the cell-mediated immunity as shown with *in vivo* tests.

79-3003. Means, G. E.; Wu, H. L. (Dep. Biochem., Ohio State Univ., Columbus, OH 43210) **The reactive tyrosine residue of human serum albumin: characterization of its reaction with diisopropyl fluorophosphate.** *Arch. Biochem. Biophys.* 194(2): 526-530; 1979 (17 references).

Reactions of *p*-nitrophenyl acetate (NphOAc) with a large excess of human serum albumin (HSA) were initiated by mixing 2-4 μl aliquats of 3 x 10^{-3} *M* NphOAc in anhydrous acetonitrile into 1 ml solutions of HSA. Reactions were then run with ^{3}H-labeled diisopropyl fluorophosphate (DFP) and HSA. The DFP reacts rapidly with a tyrosine residue of HSA at 0.02 *M*. The reversible binding is characterized by a dissociation constant of 3.6 x 10^{-3} *M* and a p*K a* of 8.3. The same tyrosine residue appears to be reacting with the NphOAc, but is inhibited by a prior reaction with DFP. The presence of decenoate inhibits both reactions. Ionic strengths of 0.05 *M* result in reactions of DFP with HSA with rate constants about half those at 0.01 *M* ionic strength.

79-3004. Golbs, S.; Fuchs, V.; Leipner, E.; Huettel, I. (Sekt. Tierprodukt. & Veterinaermed. Karl-Marx Univ., Leipzig, DDR) **Untersuchungen zur Wirkung von Pestizidkombinationen auf die Laboratoriumsratte. 1. Mitteilung: Bestimmung der akuten oralen Toxizitaet (DL50) von Pestizidkombinationen. [Studies on the effects of pesticide combinations on laboratory rats. Part 1. Determination of acute oral toxicity (LD50) of pesticide combinations.]** *Arch. Exp. Vet. Med.* 32(4): 557-561; 1978 (German).

LD50s of methyl parathion, carbaryl and lindane separately and in double or triple combinations and their effect on Hgb, hematocrit, blood glucose, SGOT, SGPT, alkaline phosphatase, and ChE levels were determined in rats by standard analytical methods. Methyl parathion toxicity in combination with carbaryl was lowered by one third. Methyl parathion toxicity was decreased by one half when used in combination with lindane. Carbaryl toxicity remained almost unchanged when used in combination with lindane; in contrast, the toxicity of carbaryl plus methyl parathion was 30% lower than the toxicity of carbaryl alone. In combination the toxicities f the pesticides were increased; 11% carbaryl, and 22% for lindane. It is suggested that more tests should be performed to clarify these results.

79-3005. Hennighausen, G.; Tiefenbach, B. (Med. Fak., Inst. Pharmakol. & Toxikol., Wilhelm Pieck Univ., Rostock, DDR) **Ueber die Mechanismen der akuten toxischen Wirkung von Chlorcholinchlorid und 2-Chloraethylphosphonsaeure (Ethephon). [Mechanisms of acute action of chlorocholine chloride and of 2-chlorethylphosphonic acid (ethephon).]** *Arch. Exp. Vet. Med.* 32(4): 609-621; 1978 (16 references) (German).

The results of experiments such as the determination of the effect of chlorocholine chloride (CCC), BMH [*N,N*-dimethyl-(2-bromoethyl) - hydrazinium bromide], and acetylcholine (ACh) on the guinea pig lung action, the guinea pig ileum *in vitro*, and the determination of mortality in mice following oral intake of 500 mg/kg CCC with and without atropine treatment are presented. Also discussed are the effects of CCC on the blood pressure, respiration and contractility of electrically stimulated *M. tibialis* of anesthesized cats, elimination of CCC in rat urine following CCC intake, and the cholinesterasic activity of the plasma, erythrocytes, and brains of rats following intake of 1500 mg/kg ethephon. Other experiments were also considered in an effort to explain the mechanism underlying the toxic effects of CCC and ethephon. CCC was found to block neuromuscular activity, causing respiratory arrest due to depolarization. Toxicity differed according to species and parasympaticomimetic effects of CCC were found to be of secondary importance. Small doses of atropine reduced, while high doses aggravated respiratory paralysis. Ethephon intoxication and its lethal effects on mice and rats are attributed to acid-induced corrosion.

79-3006. Golikov, S. N.; Barantsevich, R. P.; Kuznetsov, V. G.; Sanotskii, V. I. (Author address not given) **Vliianie armina na ultrastrukturu nervno-myshechnogo sinapsa. [Effect of Armine on ultrastructure of neuromuscular synapsis.]** *Byull. Eksp. Biol. Med.* 88(7): 95-99; 1979 (18 references) (Russian).

An attempt was made to evaluate the effect of the cholinesterase inhibitor armine on the ultrastructure of neuromuscular synapsis. Rats were sacrificed, and the nerve/muscle specimens were incubated *in vitro* with armine (5×10^{-7} g/ml) for 8 min. The phrenico-diaphragmal specimens were subjected to electrostimulation, and the numbers of synaptic vesicles (SV) in the nerve endings were estimated by electron microscopy. It was found that electrostimulation after incubation with armine resulted in marked decreases of the numbers of SV (35.8/μm^2, compared with 57.5 after incubation with armine alone, 51.0 after electrostimulation alone and 91.0 in intact controls). A simultaneous increase in the number of "coated" SV (2.27, compared with 1.88, 1.99 and 0.82, respectively) was also noted.

79-3007. Stobel-Kaminska, T. (Inst. Pathol. Clin., Acad. Med., P-20080 Lublin, Poland) **Badania *in vitro* i *in vivo* wplywu chlorfenwinfosu na adktywnosc oddechowa watroby. [Study on *in vitro* and *in vivo* effects of chlorfenvinphos on the respiratory activity of the liver.]** *Bromatol. Chem. Toksykol.* 11(3): 271-277; 1978 (36 references) (Polish).

The effect of chlorfenvinphos on liver tissue respiration in male Wistar rats was examined. Two series of experiments were carried over over a period of 8 mo. In the first, the rats were orally given 0.5, 5, 50, 500, or 5000 μg chlorfenvinphos in 1 cm^3 of 5% aqueous C_2H_5OH. The oxygen consumption was measured *in vitro* by the Warburg method. The 0.5 μg dose increased the oxygen consumption by 23% within the first 15 min and slightly within the next 30 min. The 5, 50, and 500 μg doses increased oxygen consumption within the first 15 min and then decreased it within the next 30 min. The 500 μg dose caused an immediate decrease in oxygen consumption and lasted over the entire period (up to 61%). In the second series, *in vivo* administration of the 0.01 LD50 dose caused only slight and statistically insignificant changes. Increased doses, 0.02 and 0.1 LD50, decreased oxygen consumption over a period of time.

79-3008. Strobel-Kaminska, T. (Inst. Pathol Clin., Acad. Med., P-20080 Lublin, Poland) **Badania in vitro i in vivo wplywu chlorfenwinfosu na oddychanie tkankowe nerek. [Study on the in vitro and in vivo effects of chlorfenvinphos on the respiratory activity of the kidney.]** *Bromatol. Chem. Toksykol.* 11(4): 397-402; 1978 (19 references) (Polish).

The effect of chlorfenvinphos on kidney tissue respiration in male Wistar rats was examined. Two series of experiments were carried out. In the first, 0.5, 5, 50, 500, or 5000 μg doses of chlorfenvinphos dissolved in 1 ml of 5% aqueous C_2H_5OH were given. The reference group received the 5% C_2H_5OH solution only. Oxygen consumption was measured by the Warburg method. The 0.5 μg dose slightly increased the oxygen consumption of kidney tissue within the first 45 min. With the 5 μg dose the increased oxygen consumption was statistically significant only after 30 min. The larger doses decreased kidney tissue respiration over the whole period. In the *in vivo* experiments, 0.01, 0.02 and 0.1 LD50 doses were administered, and oxygen consumption measured daily for 8 mo. The 0.01 LD50 dose increased oxygen consumption up to 45% within 45 min. The 0.02 dose caused a 45% increase in oxygen consumption only after 30 min. The 0.1 LD50 dose caused decreased oxygen consumption during the first 30 min, and a slight increase after 45 min.

79-3009. Dierickx, P. J. (Inst. Hyg. & Epidemiol., B-1050 Brussel, Belgium) **Deactivation of sodium azide in the *Salmonella*/microsome test.** *Bull. Environ. Contam. Toxicol.* 22(4-5): 660-665; 1979 (11 references).

Studies were performed in which the *Salmonella*/microsome mutagen test was used for sodium azide in the presence of plant extracts and liver extracts. When 100, 200 or 300 μl S-9 liver extracts from normal and Aroclor 1254 induced rats were used, The Aroclor induced extracts showed the higher levels of inhibition. At 400 μl S-9 there were no differences in inhibition levels of either extract. Tests with NADPH additions gave similar results. Extracts from leek, spinach, and cauliflower appeared to have an inhibitory effect on the mutagenicity of sodium azide. Other vegetables tested showed no inhibitory effect. The authors conclude that tests which show that the azide is not a carcinogen do so because of the deactivation by liver enzymes.

79-3010. Feroz, M.; Khan, M. A. Q. (Dep. Biol. Sci., Univ. Illinois, Chicago, IL 60680) **Fate of ^{14}C-*cis*-chlordane in goldfish, *Carassius auratus* (L.).** *Bull. Environ. Contam. Toxicol.* 23(1-2): 64-69; 1979 (21 references).

Nine acclimated goldfish were exposed to 25.94 ppb [^{14}C] *cis*-chlordane in 18 l of water for 24 hr, then placed in clean water. Of the six surviving fish, 3 were removed and analyzed on day 10, and the remaining 3 were transferred to clean water until termination on day 25. The compound was rapidly absorbed during the 24 hr. Extracts of day 10 samples exhibited 5 compounds by thin layer chromatography. Only 0.17% of the radioactivity were present as metabolites, the remainder being the parent compound. Day 25 samples were similar, but 0.61% of their radioactivity were in the form of metabolites. The authors concluded that the pesticide was 99% unchanged, indicating its inert storage in body tissues.

79-3011. Hanumante, M. M.; Nagabhushanam, R.; Vaidya, D. P. (Dep. Zool., Marathwada Univ., Aurangabad 431004, India) **Aberrations in the neurosecretory cells of a freshwater pulmonate, *Indoplanorbis exustus*, chronically exposed to sublethal concentration of two molluscicides, $BaCl_2$, and $CuSO_4$.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 70-72; 1979 (14 references).

Adult snails, *Indoplanorbis exustus*, were exposed to 1.0 ppm $BaCl_2$ or 0.1 ppm $CuSO_4$ for 7 days. After preparation of the central nervous systems for histological examination, the nuclear and cell diameters were measured and the neurosecretory material intensity (NSMI) was quantified. The cell dimensions were unchanged. However, the size of the nuclei changed as a result of the molluscicides. Both compounds caused a decrease in NSMI from 4 to 1.32.

79-3012. Berard, D. F.; Rainey, D. P. (Agric. Biochem., Lilly Res. Lab., Eli Lilly & Co., Greenfield, IN 46140) **Uptake and transformation of ^{14}C *N*-nitroso- di-*N*- propylamine by soybean plants.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 136-140; 1979 (3 references).

Soybean plants grown for 10 days in a greenhouse were transferred to brown bottles containing 40 ml of nutrient solution and 6.72 μg (0.17 ppm) [^{14}C] *N*- nitroso-di- *N*- propylamine (NDPA, a trifluralin contaminant) and incubated. Plants were removed after 1, 2, 3, 5, and 7 days. Plants were separated into root and shoot portions and analyzed for total radioactivity. The NDPA was absorbed and concentrated in roots, with concentrations increasing from 0.145 μg/g after the first day to 4.27 on the fifth day. BY day 7, the radioactivity was translocated into the shoots. The root levels dropped to 0.344 μg/g on day 7. The shoot levels went from 0.358 μg/g on day 5 to 0.443 μg/g on day 7. Extensive transformation of absorbed NDPA into highly water soluble products was observed.

79-3013. Sharma, S. K.; Chaturedi, L. D.; Sastry, K. V. (Dep. Zool., Hindu Coll., Moradabad 244001, India) **Acute endrin toxicity on oxidases of *Ophiocephalus punctatus* (Bloch).** *Bull. Environ. Contam. Toxicol.* 23(1-2): 153-157; 1979 (14 references).

Ten *Ophiocephalus punctatus* fish were placed in 20 l solutions of 0.005, 0.01, 0.02, 0.04, or 0.08 ppm endrin and kept at 29 ± 4°C and pH 6.9. The percent survival at 96 hr was 100%, 80%, 70%, 40%, and 0 for the 0.005, 0.01, 0.02, 0.04, and 0.08 ppm groups, respectively. The 96 hr LC50 was calculated to be 0.033 ppm. Homogenates of livers and kidneys of fish exposed to the LC50 dose for 96 hr were used to estimate oxidase activities. The activities of succinic, pyruvic, and lactic dehydrogenases were inhibited in both liver and kidney. Statistically significant inhibition was noted only for kidney lactic dehydrogenase.

79-3014. Richie, P. J.; Peterle, T. J. (Dep. Zool., Ohio State Univ., Columbus, OH 43210) **Effect of DDE on circulating luteinizing hormone levels in ring doves during courtship and nesting.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 220-226; 1979 (20 references).

Male and female ring doves were paired and allowed to raise one clutch prior to experimentation. A dose of 10 ppm *p,p'*-DDE was given to the birds in the diet for 90 days. They were then re-paired and fed 40 ppm DDE. Blood samples were taken three times daily for radioimmunoassay. The 10 ppm DDE group showed a small increase in the latency to oviposition following pairing. The 40 ppm group showed a delay of 19.5 days in the first oviposition following pairing, as opposed to 6.5 days for the control. No significant differences were seen in luteinizing hormone levels in males in the 10 ppm group or males or females in the 40 ppm group.

79-3915. Coats, J. R.; O'Donnell-Jeffery, N. L. (Dep. Entomol., Iowa State Univ., Ames, IA 50011) **Toxicity of four synthetic pyrethroid insecticides to rainbow trout.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 250-255; 1979 (18 references).

Toxicity tests were performed on fingerling rainbow trout using formulated and technical grade permethrin, cypermethrin, fenvalerate, and fenpropanate. The 24 hr LC50 values as ppb active ingredient were lower for the formulated than the technical grade compounds. Permethrin had LC50 values of 135 and 61 ppb, cypermethrin values were 55 and 11 ppb, fenvalerate values were 76 and 21 ppb, and fenpropanate values were 76.7 and 816 ppb, for the two formulations respectively.

79-3016. Morgan, J. M.; Hickenbottom, J. P. (Dep. Pharmacol., Sch. Pharm., Univ. Mississippi, University, MS 38677) **Comparison of selected parameters for monitoring methoxychlor-induced hepatotoxicity.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 275-280; 1979 (14 references).

Thirty-five male Holtzman rats were fed (by intubation) 16 ml/kg pure corn oil or 10, 40, 160 or 640 mg methoxychlor (MC) in corn oil/kg body weight. All animals were sacrificed after 24 hr. The activities of synthetase 1 and total synthetase were calculated; no significant changes were noted for any group when compared to controls. Liver glycogen levels exhibited a dose-related decrease with each increase in dose of MC, with the highest dose resulting in a decrease of 75%. The level of glucose-6-phosphatase increased significantly at the highest dose. Phosphorylase decreased significantly at the two highest concentrations of MC, and lactate decreased significantly at the highest doses of MC.

79-3017. Mehta, R. S.; Hawxby, K. W. (SEA/CR Bio. Res., Langston Univ., Langston, OK 73050) **Effects of**

simazine on the blue-green alga *Anacystis nidulans*. *Bull. Environ. Contam. Toxicol.* 23(3): 319-326; 1979 (16 references).

In order to study the effects of the herbicide simazine on blue-green algae, a culture of *Anacystis nidulans* was grown until an optical density (OD) of 0.9 at 678 nm was reached, at which time it was treated with 10^{-5} *M* simazine. Aliquots were removed after 0, 12, 24, 48 and 53 hr and processed for electron microscopy. The effects on phycobiliprotein and chlorophyll were noted. After 12 hr the thylakoids became granular and after 48 hr the thylakoids appeared empty. The polyhedral bodies became larger and RNA decreased the eventually became depleted. Chlorophyll levels, determined as a function of OD, of treated cultures remained about equal (0.532 at 0 to 0.569 at 72 hr), while the controls increased from 0.616 to 1.077.

79-3018. Hall, R. J.; Swineford, D. (Patuxent Wildl. Res. Cent., Laurel, MD 20811) **Uptake of methoxychlor from food and water by the American toad (*Bufo americanus*).** *Bull. Environ. Contam. Toxicol.* 23(3): 335-337; 1979 (9 references).

Studies were performed to determine the nature of uptake of pesticide from food and water by the American toad. Toads were placed in tanks and fed mealworms containing 0.024 ppm methoxychlor for either 1 or 6 days. A third group was fed worms with 0.32 ppm pesticide for 1 day. In another experiment, toads were exposed to 0.069 ppm pesticide in their water for 1, 6, or 35 days. At the end of each experiment, toads were killed by freezing, and the skins and gastrointestinal tracts were removed. Methoxychlor levels were determined by gas chromatography. Toads fed the pesticide had residues in their tissues. The 0.024 ppm group had a mean level of 0.013 ppm after 1 day. The 6 day exposure group had 0.008 ppm. The group fed 0.325 ppm contained 0.033 ppm. By far, the highest residues were seen in animals exposed to pesticide-contaminated water. After 1, 6, and 36 days, there was 0.145, 0.244 and 0.124 ppm, respectively. It is suggested that methoxychlor, like many other pesticides, is rapidly eliminated by the animals.

79-3019. Greichus, Y. A.; Libal, G. W.; Johnson, D. D. (Chemistry Dep., South Dakota State Univ., Brookings, SD 57007) **Diagnosis and physiologic effects of pentachlorophenols on young pigs. Part 1. Effects of purified pentachlorophenol.** *Bull. Environ. Contam. Toxicol.* 23(3): 418-422; 1979 (11 references).

The effect of pentachlorophenol (PCP) on young pigs was determined. Six-wk-old pigs were fed 0, 5, 10 and 15 mg PCP/kg body weight for 30 days and their tissues were analyzed for PCP. Weight gains by experimental and control groups did not vary. PCP levels in the 5 mg dose group were 78.1 ppm in blood, 6.74 ppm in muscles, 22.0 ppm in kidneys, and 28.9 ppm in liver. Pesticide levels at other dose rates did not vary significantly from the low dose rate pigs. These were, however, much higher than controls. No signs of toxicity occurred during this study. Liver enlargement, lowered white blood cell counts and higher blood urea nitrogen values were observed.

79-3020. Pizzolato, T. D.; Reghr, D. L. (Dep. Plant Sci., Univ. Delaware, Newark, DE 19711) **Early modification of the internodal anatomy of *Glycine max* sprayed with 2,4-DB.** *Can. J. Bot.* 57(12): 1340-1344; 1979 (16 references).

Twenty-seven days after planting seeds of *Glycine max* Merrill var. Celest, those plants whose fourth trifoliate leaf's central leaflet was between 1.0 and 1.2 cm long were sprayed with 2,4-DB. The earliest symptoms appeared 4 days after spraying and centered about the cambium at the time when the interfascicular parenchyma cells and the adjacent cortical parenchyma cells enlarged and divided in several planes. The sequence of changes noted in the plants suggests that the agent moved through the conducting phloem of the metaphloem and early secondary phloem of the leaf traces. From here the chemical stimuli migrates to the rest of the pholem and through the interfascicular regions into the cortex. Little movement of the chemical is suspected in the cambium, xylem, or pith, as there was no apparent stimulation of changes there.

79-3021. Jeanne, N. (Lab. Biol. Cell. Veg., Univ. Paris VII, F-75005 Paris, France) **Effets du lindane sur la division, le cycle cellulaire et les biosyntheses de deux algues unicellulaires. [Effects of lindane on the division, cell cycle and biosynthesis of two unicellular algae.]** *Can. J. Bot.* 57(13): 1464-1472; 1979 (20 references) (French).

The effects of lindane on two cultivated unicellular algae *Dunaliella bioculata* and *Amphidinium carterae* are described. Morphological changes of enlarged cells, decreased number of microtubules, enlarged golgi apparatus, inhibited cell division, endomultiplication of the organelles, and abnormal partition of nuclei were found. The *in vitro* polymerization of tubulin was not affected by lindane. In synchronously dividing *D. bioculata*, no blockage of mitosis was observed even if lindane was added after the outburst of cell division during the dark period. RNA and protein content was increased less rapidly in treated cells than in control cells, and continued to increase more or less rapidly during the second cell cycle. Lindane, at concentrations of 10 μg/ml, strongly inhibited DNA synthesis in the first cell cycle, and it did not resume during the second cell cycle.

79-3022. Rinkus, S. J.; Legator, M. S. (Dep. Prevent. Med. & Commun. Health, Div. Environ. Toxicol., Univ. Texas Med. Branch, Galveston, TX 77550) **Chemical**

characterization of 465 known or suspected carcinogens and their correlation with mutagenic activity in the *Salmonella typhimurium* system. *Cancer Res.* 39(9): 3289-3318; 1979 (255 references).

Evidence concerning the value and limitations of *in vitro* testing in general and microbial testing in particular for determining mutagenic activity of specific chemicals is reviewed. It is emphasized that *in vitro* testing cannot entirely duplicate the metabolism which will occur *in vivo*. This will sometimes allow false positives and false negatives to occur during compound testing. It is pointed out that false negatives occur for two major reasons. First the inability to devise an *in vitro* activation system which can be reliably used in a standard way. Secondly, an inability to detect the entire spectrum of mutational events which lead to the induction of cancer. A tabulation of the 465 suspected carcinogens is given, which lists the reference work of the compound and the group identifying it as carcinogen.

79-3023. Hsia, M. T. S.; Adamovics, J. A.; Kreamer, B. L. (Dep. Entomol., Univ. Wisconsin, Madison, WI 53706) **Microbial mutagenicity studies of insect growth regulators and other potential insecticidal compounds in *Salmonella typhrimurium*.** *Chemosphere* 8(8): 521-529; 1979 (16 references).

Mutagenic activities of selected insect growth regulators (IGR) and several potential insecticide compounds were investigated using *Salmonella typhimurium* mutants that reveal base-pair substitution and frameshift mutagens. The first group of compounds tested included JH-1, methoprene, and precocenes I and II. No mutagenic activity was obsereved, but precenes I and II were cytotoxic toward one *S. thyphimurium* strain. The second study group was made up of naturally occurring molecules with potential insecticidal activity: acacetin, biochamin A, catechin, fisetin, irigenin, and myricetin. Myricetin and fisetin were mutagenic against two *S. thyphimurium* strains, while acacetin and irigenin were active against only one strain. Biochamin A and catechin showed no mutagenic activity. The final group was tested for mutagenic activity via induced chemosterilization, and consisted of β-asarone, α-asarone, anethole, and isoeugenol. All four were ineffective mutagens, while β-asarone revealed moderate cytotoxic activity. The importance of short-term mutagenicity bioassays was confirmed.

79-3024. Oliver, J. E.; Lusby, W. R. (Pestic. Degr. Lab., Agric. Environ. Qual. Inst., SEA, ARS, USDA, Beltsville, MD 20705) **Formation of a methylsulfinamide during the metabolism of a dinitroaniline by *Streptomyces* sp.** *Chemosphere* 8(8): 563-568; 1979 (11 references).

The isolation of a novel sulfur-containing metabolite of α,α,α- trifluoro- 2,6- dinitro-*p*- toluidine (a metabolite of trifluralin) is described. The metabolite was isolated from a microbial (*Streptomyces* sp.) culture by extraction followed by sequential dry-column and HPLC chromatography and was assigned to structure of *N*-[2-amino- 3-nitro- 5- (trifluoromethyl) phenyl] methane sulfinamide. Attempts to synthesize the metabolite by reacting 6-nitro- 4- (trifluoro methyl) benzene- 1,2-diamine (a compound also isolated from the microbial culture) with methane sulfinyl chloride were unsuccessful.

79-3025. Smith, L. L.; Rose, M. S.; Wyatt, I. (Cent. Toxicol. Lab., ICI, Alderley Park, Cheshire, England) **The pathology and biochemistry of paraquat.** *Ciba Found. Symp.* 65: 321-341; 1979 (9 references).

Paraquat damage to the lung occurs in two phases. The first consists of a destruction phase damaging type I and type II alveolar epithelial cells, and lasts a few days. Edema and hemorrhage occur during this phase. The second phase is a reparative one with regeneration of the epithelium and a characteristic proliferation of fibroblasts. Paraquat present in lung cells undergoes a cyclical reduction and oxidation producing superoxide anion. Lipid peroxides may form, causing cell death. However, in cases of minimal ultrastructural damage to the lung cells, paraquat stimulates the pentose-phosphate pathway and both reduces the level of NADPH and inhibits fatty acid synthesis in the lung. It is suggested that the primary mechanism of paraquat toxicity involves the extreme oxidation of NADPH, thus inhibiting vital physiological processes and rendering the cell susceptible to attack from hydroperoxides.

79-3026. Carricaburu, P.; Lacroix, R.; Lacroix, J. (Dep. Physiol. Hum., Fac. Med., Paris Univ. Quest, F-75270 Paris Cedex 06, France) **Etude de l'influence de pesticides organochlores sur la reponse electrique oculaire de la Souris blanche. [Study of the effects of organochlorine pesticides on the ocular electric response in albino mice.]** *C. R. Soc. Biol.* 173(1): 147-152; 1979 (7 references) (French).

The effects of DDT (6-150 mg) and BHC (25-110 mg) on the nervous response of male and female NMRI Swiss mice were studied by electroretinography. The pesticides, dissolved in dimethylacetamide, were injected ip. The animals were anesthetized with pentobarbital before the tests. Both compounds reduced the amplitude of the β-wave of the electroretinograms without modifying its latency. The α-waves remained unchanged. The findings indicate that the organochlorine pesticides do not act on photoreceptors or synapses, but they act only on bipolar and ganglionic neurons.

79-3027. Kabir, S. M. H.; Begum, R. (Dep. Zool., Univ. Dacca, Dacca, Bangladesh) **Toxicity of three**

organophosphorus insecticides to shinghi fish, *Heteropneustes fossilis* (Bloch). *Dacca Univ. Stud.* 26(1): 115-122; 1978 (5 references).

Heteropneustes fossilis was exposed to three organophosphorus insecticides commonly used to control pests in the rice paddy fields of Bangladesh. The behavioral reaction and the extent of histopathological damage in th liver and intestinal tissues were determined. Specimens exposed to 5, 10, and 20 ppm in diazinon were moribund within 3.5, 1.5, and 1 hr, respectively. Fish exposed to 1.25 and 2.50 ppm of diazinon did not show any unusual symptoms. Even at doses of 20 ppm, dimecron was not toxic to fish. Fish exposed to carbicron (dicrotophos) showed only a short period of erratic behavior at 20 ppm. There were noticable histological changes in the treated fish including shrinkage of the tunica propria and partial detachment of the villi. Exposure to diazinon resulted in fusion of the villi and localized necrosis of the columnar epithelial cells. Damage to hepatic cells included vacuolation, cells devoid of nuclei, and pycnosis of the nuclei. Dimecron (phosphamidon) caused no pathological effects to the intestine but cytoplasm degeneration was observed in hepatic cells of specimens exposed to 10 and 20 ppm.

79-3028. Vizethum, W.; Goerz, G. (Hautklin, Univ. Dusseldorf, D-40000 Dusseldorf, BRD) **Ist 2,4,5-trichlorophenol ein Porphyrogen? [Is 2,4,5,-trichlorophenol a porphyrogen?]** *Dermatosen Beruf Umwelt* 27(3): 78; 1979 (7 references) (German).

To determine whether 2,4,5-TCP (trichlorophenol), a metabolite of HCB (hexachlorobenzene), is the cuase of HCB induced phorphyrism, its porphyrogenic activity was studied. Rats were fed 0.05% 2,4,5-TCP in their diet and the levels of total porphyrins, δ-aminolevulinic acid (ALA) and porphobiligen (PBG) were monitored in their urine. On day 56 elimination of the porphyrins, ALA and PBG rose markedly. However, by day 70 the treated animals showed no significant differences in excretion patterns of these compounds when compared to controls. Pentachlorobenzene and pentachlorphenol were similarly examined. The three tested compounds were not found to be porphyrogenic.

79-3029. Kurtz, P. H. (Univ. California, Davis, CA) **An investigation of mammalian tolerance to organophosphates: the effect of parathion chronically fed to rats.** *Diss. Abstr. Int. B.* 40(2): 697; 1979.

To examine the ability of rats to withstand acute toxic doses of parathion after they have been chronically given sub-lethal doses for a period of weeks, groups of 10 rats each were fed diets containing various amounts of parathion for periods varying from 1 to 8 wk prior to challenging them with an acutely toxic dose. Animals showed an increased sensitivity to the lethal effects of the challenge dose, varying directly with the duration and amount of parathion fed in the diet. Thus, the opposite of tolerance, increased sensitivity, was seen. To test tissue sensitivity of acetylcholine (ACh), ilea were removed from rats prefed parathion for up to 8 wk and tested *in vitro* for sensitivity to ACh. Cholinergic adaptation rather than decreased sensitivity was noted. The conclusion was drawn that tolerance does not develop to OPs (organophosphates) and that tissue sensitivity to ACh is not affected by chronic OP administration. An alternate pathway for ACh removal and destruction is suggested to explain observed adaptations during chronic OP administration. (Author abstract by permisssion, abridged. Copies of the thesis are available from University Microfilms, order No. 7917163).

79-3030. Ouellette, R. E. (Univ. Connecticut, Storrs, CT 06268) **Dasanit inhibition of tissue esterases and amidases and interactions with ester and amide drugs.** *Diss. Abstr. Int. B.* 40(2): 698; 1979.

This study was undertaken to evaluate the interaction potential of the widely used organophosphorus insecticide Dasanit (fensulfothion) with the local anesthetic ester, procaine, and the analgesic and antipyretic amide, acetanilide, in the mouse and rat. Groups of 5 or 6 male mice were treated with 1-10 mg Dasanit/kg and sacrificed without challenge 1 hr later. A dose of 5 mg/kg did not inhibit brain cholinesterase activity, yet caused greater than 50% inhibition of liver hydrolysis of diethylsuccinate, triacetin, and procaine, A time-course study indicated that liver hydrolysis of these substrates was maximally inhibited at 0.5-1 hr after 7.5 mg/kg. Several additional substrates were used to study the interaction of Dasanit with procaine and acetanilide in the rat. It is suggested that commonly used insecticidal organophosphates, at apparently non-toxic doses, may alter the metabolism and toxicity of ester- and amide-containing drugs which are dependent upon carboxylesterases for their biotransformation. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7917364).

79-3031. Ross, J. H. (Univ. California, Davis, CA) **Structure-activity relationships in the toxicology of 4,4′-bipyridylium salts in the rat (*Rattus norvegicus*) and the duckweed (*Spirodela oligorrhiza*).** *Diss. Abstr. Int. B.* 40(2): 699; 1979.

Twelve homologues of the commercial herbicide paraquat were synthesized for the purpose of determining structural specificity with regard to plant and animal toxicity. Toxicity of these compounds was assessed in Sprague-Dawley rats and duckweed, an aquatic plant. Herbicidal potency of the viologens was found to correlate with the bulk of the *N*-alkyl group. Herbicidally effective concentrations were 2.7, 12, 236, 71, 31, 51, 13, and 43 μM for methyl (paraquat), propyl, isopropyl, butyl, methyl-pentyl, hexyl, octyl, and benzyl viologen, respectively. The lowest lethal dose in rats (female, subcutaneous) for the same

compounds was 105, 351, 185, 125, 55, 37, 281, and 18 μmole/kg. Mammalian selectivity ratios indicate that none of the compounds tested were any less toxic to mammals than plants compared to paraquat. Morphologic changes produced in rats upon lethal sc injection were similar for the various compounds. An alternative mechanism of toxic action of the viologens was proposed which invokes the ability of these compounds to shunt electrons from critical biochemical processes in mitochondria and microsomes in addition to possible damage produced by oxygen radicals following reoxidation of the biochemically reduced viologen. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7917174)

79-3032. Hurst, H. E. (Univ. Kentucky, Lexington, KY) **An *in vivo* examination of chemical alteration of the hydrolytic detoxication and elimination of methylcarbamates in rats.** *Diss. Abstr. Int. B.* 40(2): 696-697; 1979.

Studies of methylcarbamate metabolism and elimination designed to assess relative changes in detoxication processes were conducted in rats with the relatively nontoxic methylcarbamate CPMC and the anticholinesterase insecticides aldicarb, carbaryl, carbofuran and Croneton (ethiofencarb). The kinetics of hydrolytic elimination of $^{14}CO_2$ from the rats generally were biphasic in nature, with a majority of cleavage occurring at exponentially declining rates during the initial phase. The duration of the A phase was about 8-10 hr post treatment encompassing the period of most symptoms or deaths resulting from the treatments. Half-times of $^{14}CO_2$ elimination calculated from the A phase of *in vivo* hydrolysis were linearly dependent on dosage. Further, the increases in half-times correlated with the appearance and duration of poisoning symptoms as the dosage of insecticides increased. A linear relationship existed between the A phase half-time and dosage, and the potential of each methyl carbamate to slow the course of its hydrolytic detoxication was indicated by the steepness of the slope of the dose half-time function. These slopes were specific for each compound. Other studies showed that the A phase hydrolytic half-time increased linearly in response to increases in concurrent dosages of other carbamates, organothiophosphate insecticides and certain other enzyme-inhibiting molecules. Changes in the efficacy of hydrolytic processes, along with certain instances of altered urinary excretion, were shown to be metabolic correlates of methylcarbamate poisoning. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7918092.)

79-3033. Marshall, T. C. (Univ. Kentucky, Lexington, KY) **Bioavaiability of carbamate insecticide plant residues.** *Diss. Abstr. Int. B.* 40(2): 729-730; 1979.

Using stem injection of radiolabeled preparations of carbofuran, Croneton (ethiofencarb), carbaryl, and aldicarb, bound and water soluble residues were generated in bean plants. When bound residues of carbofuran, Croneton, and carbaryl were administered to rats as dietary supplements, 85-98% of the dose was excreted in the feces in 2 days, while 1-16% was eliminated in the urine. Only 0.3-2.5% was detected in the bile. The bound residues were not readily absorbed from the gastro-intestnal tract. Within 2 days after oral treatment to rats of the water soluble residues of the carbamates, urinary excretion amounted to 65-90% of the dose. Fecal elimination of radiocarbon did not exceed 10% of the doses. The water soluble residues were highly bioavailable. Bioavailability studies on carbofuran and carbaryl plant residues using freeze-dried plants, not subjected to solvent extraction, showed that after 3 days, 47 and 69% of the administered residues was eliminated via the urine, while 50 and 22% of the respective doses was voided in the feces. It was concluded that the organosoluble and water soluble residues contained in the freeze-dried plants were bioavailable, while the bound were not. Conjugates of carbamate insecticides formed in plants may provide a bioavailable source of toxic exogenous compounds if consumed in the diet of man and other animals. Therefore, it is essential that the toxicological significance of these residues be considered in the evaluation of the potential health hazards associated with the use of carbamates as crop protectants. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7918105.)

79-3034. Zaitsev, Iu. P.; Golovenko, V. K. (Inst. Biol. Landlocked Seas, Ukrainian SSR Ac. Sci., Kiev, USSR) **Nakopichennia, metabolizm ta vivedennia DDT chornomors'koiu medieiu. [Accumulation, metabolism, and elimination of DDT by the Black Sea mussels.]** *Dopov. Akad. Nauk. Ukr. RSR Ser. B* (5): 371-374; 1979 (13 references) (Ukrainian).

The accumulation, metabolism, and elimination of DDT in Black Sea mussels were studied in an aquarium containing sea water. The DDT concentration in the hepatopancreas was 5.14 mg/kg after 1 hr exposure, 5.38 mg/kg after 24 hr exposure, and 33.20 mg/kg after 96 hr. The DDT concentrations in the water were 229 mg/l after 1 hr, 21.05 mg/l after 24 hr, and 60.05 mg/l after 96 hr. The DDT was accumulated mainly in the gonads and hepatopancreas. The DDD (TDE) levels found in the hepatopancreas afer 1, 24, and 96 hr were 0.58 mg/kg, 1.59 mg/kg, and 8.44 mg/kg, respectively. The elimination of DDT and DDD from the mussels in pure water was slow, especially from the gonads and hepatopancreas, but considerably faster from the gills. These findings indicate that mussels are good indicators of DDT contamination of salt water.

79-3035. Wolff, T.; Deml, E.; Wanders, H. (Abt. Toxikol., Inst. Toxikol. & Biochem., Gesellsch. Strahlen &

Umweltforsch., D-8042 Munich, FRG) **Aldrin epoxidation, a highly sensitive indicator specific for cytochrome P-450-dependent mono-oxygenase activities.** *Drug Metab. Dispos.* 7(5): 301-305; 1979 (33 references).

Aldrin epoxidation was characterized by investigating the influence of the inducers phenobarbital and 3-methylcholanthrene and the effect of the inhibitors of cytochrome P-450- and P-448-reactions, SKF 525-A, metyrapone, and 7,8-benzoflavone, in rat liver microsomes. Animal pretreatment with phenobarbital, a mono-oxygenase inducer, increased epoxidation rate 3-fold, while 3-methylcholanthrene treatment depressed enzyme activity. Treatment with 3-methylcholanthrene did not change the apparent K_M of the reaction which equaled 18 μM. Animals treated with phenobarbital had a K_M of 28 μM. Thus, the same or similar forms of mono-oxygenase catalyzes the epoxidation in the different microsomal preparations. Sensitivity of microsomes to inhibitors was low. Enzyme activity was reduced only 50% by 0.7 nM SKK 525-A and 0.4 nM 7,8-benzoflavone, while 0.5 nM metyrapone caused an inhibition of 10-45%. The age dependency of the development of enzyme activity in untreated rats increased almost parallel to the activity of ethylmorphine demethylation between 3 and 10 wk of age. Thus, aldrin epoxidation is a sensitive and selective assay for the activity of cytochrome P-450-dependent forms of mono-oxygenases.

79-3036. Olajos, E. J.; Rosenblum, I.; Coulston, F.; Strominger, N. (Inst. Comp. & Hum. Toxicol., Albany Med. Coll., Union Univ., Albany, NY 12208) **The dose-response relationship of trichlorfon neurotoxicity in hens.** *Ecotoxicol. Environ. Saf.* 3(3): 245-255; 1979 (10 references).

Adult White Leghorn hens were given oral or sc doses of 50-300 mg/kg of trichlorfon and were observed for up to 30 days after dosing for acute toxicological effects and paralysis. Oral doses of 100 mg/kg or more produced more severe acute toxicological effects after 24 hr than did corresponding sc doses. Signs of neurological dysfunction (ataxia, paralysis) were apparent 12-28 days after dosing. Neurotoxic esterase (NTE) activities diminished 24 hr after trichlorfon treatment; at the highest sc dose levels NTE was inhibited 63%. Oral doses of trichlorfon near the LD_{50} level (75 mg/kg) resulted in no, or minimal (0-20%) NTE inhibition. A multifocal neuropathy affecting both the CNS and PNS was observed about 1 mo after dosing.

79-3037. Arany, I.; Rady, P.; Bojan, F.; Kertai, P. (Public Health & Epidemiol. Inst., Debrecen Med. Sci. Univ., Debrecen, Hungary) **Az uretan, dimetilnitrozamin, Paraquat es butilalt hidroxitoluol hatasa az eger-tudo aerob tejsavtermelesere es a glikolizis kulcs-enzimeinek aktivitasara. [Effects of urethane, dimethylnitrosamine, paraquat, and butylated hydroxytoluene on the aerobic lactic acid production of mouse lung and on the activity of the key enzymes of glycolysis.]** *Egeszsegtudomany* 23(2): 142-146; 1979 (20 references) (Hungarian).

The effects of single ip doses of urethane (1,000 mg/kg), dimethylnitrosamine (DMNA; 10 mg/kg), paraquat (20 mg/kg), and butylhydroxytoluene (BHT; 800 mg/kg) on the aerobic lactic acid production in the lungs, and on the activity of the key enzymes of glycolysis (hexokinase, phosphofructokinase, and pyruvate kinase) were studied in 6-8 wk-old male and female CFLP mice. Urethane and DMNA, which induce lung tumors, caused permanent increases in the lactic acid production in the lungs, and in the activities of the glycolytic enzymes. Paraquat and BHT, which are not carcinogenic, caused only transient increases in these parameters. Both the lactic acid production in the lungs and the enzyme activities returned to normal 7 days after paraquat treatment.

79-3038. Singh, B. D.; Singh, R. B.; Singh, R. M.; Singh, Y.; Singh, J. (Dep. Genet. & Plant Breeding, Fac. Agric., Banaras Hindu Univ., Varanasi 221005, India) **Effect of insecticides on germination, early growth and cytogenetic behavior of barley (*Hordeum vulgare*).** *Environ. Exp. Bot.* 19(3): 127-132; 1979 (19 references).

The effects of treatment of seeds with insecticide solutions on germination, early seed growth, and genetic aberrations in barley (cv Ratna) were investigated. Seeds were treated with 0.1% solutions of six systemic [Dimecron (phosphamidon), Citrolane, Thimet (phorate), Counter (terbufos), Furadan (carbofuran), and Disyston (disulfoton)] and 3 nonsystemic [endrin, Cythion (malathion), and Ambithion] insecticides, and ethyl methane sulfonate (EMS, as positive control). Ambithion caused the most significant reduction (67%) in germination and in seedling height (mean 3.8 cm vs. control 7.6 cm), while endrin, Ambithion, Dimecron, and Furadan induced higher sterility than the potent mutagen EMS. Cytological aberrations at mitotic metaphase, meiotic metaphase I, and at anaphase I were observed in treated populations in significantly higher frequencies than in controls.

79-3039. Neskovic, N. K. (Dep. Pestic, INEP, Yu-11080 Zemun, Yugoslavia) **Effects of subacute feeding of carbaryl on mixed function oxidase and on acute toxicity of parathion and propoxur in rats.** *Environ. Res.* 20(1): 148-153; 1979 (13 references).

The effects of carbaryl on NADPH-cytochrome *c* reductase activity and cytochrome P450 content in liver microsomes, and on acute toxicity of parathion and propoxur were examined. Food containing carbaryl (2000 ppm) was provided to rats during a 60 day period. In animals fed diets with carbaryl, no statistically significant difference in body weight was observed when compared with control animals, although an increase in liver weight was established in males. The NADPH-cytochrome *c*

reductase actvity was decreased significantly in carbaryl treated animals. Cytochrome P450 content increased by 36% in male animals fed diets containing carbaryl. The ip LD50 of parathion and propoxur increased in animals fed diets containing carbaryl. The increase of the parathion LD50 was over 50% in females; while the LD50 for propoxur in males increased 34%, and in females 36% in relation to the values obtained in control animals. (Author abstract by permission of Academic Press)

79-3040. Elder, J. H.; Morre, D. J.; Yunghans, W. N. (Scripps Clin. & Res. Fnd., La Jolla, CA) **Calcium uptake by sarcoplasmic reticulum of rat muscle: inhibition by DDT.** *Eur. J. Cell Biol.* 19(3): 231-238; 1979 (35 references).

The effects of DDT on calcium transport by the sarcoplasmic reticulum of rat muscle were investigated because of the potential relationship between the mode of action of DDT and the active movement of divalent cations. DDT inhibited calcium uptake in the 28,000 *g* fraction (smooth membrane vesicles). Calcium accumulation was 4.50 μmoles Ca^{2+}/mg prot/min 39 sec after calcium addition in the absence of 6 μM DDT as opposed to 0.81 in the presence of 6 μM DDT. The control rate declined to 0.79 μmoles/mg prot/min after 2 min while the rate in the presence of DDT was 1.50 μmoles/mg prot/min. The DDT inhibited basal ATPase activity of the microsomal fraction but did not inhibit calcium-stimulated increment ATP hydrolysis. Thus, the inhibition of calcium uptake is caused by some other means than the inhibition of calcium-stimulated ATPase. Experiments with mice showed an antagonistic interaction between DDT and ouabain and oligomycin. Loss of muscle control in organisms poisoned by DDT may be due to the presence of the lipid-soluble DDT molecule within the membrane of the sarcoplasmic reticulum. This would cause interference with the normal rapid uptake of calcium ions which is required for muscle relaxation.

79-3041. Aitio, A.; Vainio, H.; Parkki, M. (Dep. Physiol., Univ. Turku, Turku, Finland) **Effect of 2,3,7,8-tetrachlorodibenzo- p-dioxin on UDP glucuronosyltransferase activities in the Gunn rat.** *Excerpta Med. Int. Congr. Ser.* 440:200-202; 1978 (21 references).

The induction of UDP glucuronosyltransferase (UDPGT) in the Gunn rat was investigated after administering 2,3,7,8-tetrachlorodibenzo- p-dioxin (TCDD). Also, the activation of the enzyme by diethylnitrosamine (DEN) was studied. TCDD was administered to Wistar, Gunn, and heterozygous rats ig at a dose level of 20 μg/kg. After 7 days, the rats were sacrificed and a washed microsomal fraction was prepared. Digitonin was used to activate the enzyme, and DEN was added to the incubation mixture at an optimal concentration of 15 mmol/l. UDPGT activity was determined using as aglycones: bilirubin, *p*-nitrophenol, o-amino-phenol, and 4-methylumbelliferone. Results indicated three separate UDPGT units: one for bilirubin, and two for xenobiotic substrates. The Gunn rat demonstrated two defects. It did not possess induction capability and had a negligible activity of bilirubin transferase.

79-3042. Boikova, V. V.; Golikov, S. N.; Korkhov, V. V. (Lab. Pharmacol., Inst. Obstet. & Gynecol., Leningrad, USSR) **Zashchitnoe deistvie estrogen-progestinovykh preparatov pri narushenii reproduktivnoi funktsii subtoksicheskimi dosami fosfororganicheskikh soedinenii. [Protective effect of estrogen-progestin drugs during disorders of reproductive function induced by subtoxic doses of organophosphorus compounds.]** *Farmakol. Toksikol. (Moscow)* 42(4): 426-429; 1979 (10 references) (Russian).

An attempt was made to evaluate whether some estrogen-progestine drugs can be used for prophylaxis of disorders of reproductive functions induced by organophosphorous compounds. Mature rats with normal 4-5-day estrus cycles were divided into 7 groups: group 1 served as intact control, group 2 received Nibufin (0.8 mg/kg: 0.1 LD50), group 3 received Armine (0.02 mg/kg: 0.1 LD50), group 4 received Armine in combination with Megastranol (1.5 mg/kg), group 6 received Nibufin in combination with Megastranol, group 5 received Armine in combination with Infecundine (0.5 mg/kg), and group 7 received Nibufin in combination with Infecundine. All drugs were administered po, for 14 days. Reproductive function disturbances were recorded in 75% and 92% of rats from groups 2 and 3, respectively. These disorders included the changes in implantation and plancenta formation, stillbirth, resorption and maceration of the fetus. Steroid drugs, especially Infecundine, decreased the incidence of disorders of the placenta and caused normalization of RNA metabolism in the uterus.

79-3043. Wyrobek, A. J. (Biomed. Sci. Div., Lawrence Livermore Lab., Univ. California, Livermore, CA 94550) **Changes in mammalian sperm morphology after x-ray and chemical exposures.** *Genetics* 92(Suppl. Pt. 1): 105-119; 1979 (57 references).

In this review the use of sperm head morphology in the mouse as a screen for environmental effects on germ cells is discussed. It is pointed out that sperm shape is genetically controlled, as is the fraction of abnormal sperm. The effects of various agents on sperm morphology are described. Following x-ray exposure, the fraction of abnormal sperm was shown to increase with dose and varied with time after exposure. Striking dose-dependent increases in abnormal sperm were produced by ethyl methanesulfonate and benzo(a)pyrene. Smaller effects were seen with aminopterin, and no effects were seen with

DDT, acetylsalicyclic acid, ascorbic acid, calcium cyclamate, glucose phenobarbital, aflatoxin B_1, dimethylnitrosamine, and urethane. In general, sperm shape is affected by those agents considered to be mutagenic. The problems of determining the genetic implications of induced sperm abnormalities and the applicability of sperm morphology testing are discussed.

79-3044. Del Dot, M.; Betta, A. (Uff. Sanit. Trento, Trento, Italy) **Il problema del monitoraggio di operatori agricoli esposti ad organo-fosforici. Una esperienza in Provincia di Trento. [Monitoring of agricultural workers exposed to organophosphorus compounds. An experience in the Trento Province, Italy.]** *Ig. Mod.* 72(4): 368-375; 1979 (20 references) (Italian).

The serum cholinesterase activity was determined in 44 male orchard workers (aged 20-60 yr, avg age 44.3 yr) before, during, and after occupational exposure to a mixture of organophosphate, organochlorine, and dithiocarbamate pesticides. The mean value of the cholinesterase activity was 2,340 mU/ml before exposure, 2,882 mU/ml during exposure, and 2,621 mU/ml after exposure. The values observed during and after exposure were significantly increased when compared to the initial cholinesterase activity levels.

79-3045. Singh, V. P.; Singh, B. D.; Singh, R. B.; Dhar, B.; Singh, R. M.; Srivastava, J. S. (Dep. Genet. & Plant Breeding, Banaras Hindu Univ., Varanasi 221005, India) **Effect of herbicide, alachlor, on growth and nitrogen fixation in cyanobacteria and rhizobia.** *Indian J. Exp. Biol.* 16(12): 1325-1237; 1978 (11 references).

Rhizobial and cyanobacterial cultures were inoculated in media containing different concentrations of alachlor. *Rhizobium* strain SU391 was more resistant to alachlor than other strains. A unicellular non-nitrogen-fixing species was less sensitive than two nitrogen-fixing, filamentous species of cyanobacteria. A 4-5 times greater concentration of alachlor was tolerated by the rhizobia than by the cyanobacteria. When grown in 5-40 μg/ml alachlor, heterocysts in *Anabaena doliolum* were spaced more widely. Only at concentrations higher than 20 μg/ml was nitrogen fixation adversely affected in *A. doliolum* and *Nostoc muscorum.*

79-3046. Nagendran, R.; Shakuntala, K. (Dep. Zool., Bangalore Univ., Bangalore 560001, India) **Studies on toxicity of biocides to cyprinid forage fishes. Part I. Effects of sublethal concentrations of sodium pentachlorophenate on the ecophysiology of *Puntius ticto* (Ham).** *Indian J. Exp. Biol.* 17(3): 270-273; 1979 (27 references).

Puntius ticto was exposed to PCP (sodium salt, Na-PCP) at sublethal concentration levels. Significant increases in the opercular/surfacing activity was noted. A marked decrease in the amount of food consumed during the course of a day was noted when the fish were exposed to Na-PCP. A decrease in growth rate was also noted. While this reduction in growth rate may be due to the reduced intake of food, it may also be influenced by an increased mitochondrial metabolism and subsequent energy release. The concentrations of Na-PCP used in the study were 1.44, 4.32, 7.20, 10.08, and 12.96 ppb.

79-3047. Janardhan, A.; Yadgiri, B.; Reddy, E. M.; Naidu, N. V. (Dep. Pharmacol. & Toxicol., Coll. Vet. Sci. Andra Pradesh Agric. Univ., Hyderabad 500030, India) **Effect of DDT pretreatment on malathion toxicity in chicks.** *Indian J. Exp. Biol.* 17(3): 315-317; 1979 (21 references).

Twenty-one-day-old, male, white, Leghorn chicks (Babcock strain) were exposed to DDT and malathion to determine the potentiation or protective effects of DDT. DDT was given po, 1, 2, 3 or 4 days prior to malathion at a dose rate of 150 mg/kg. Optimum protection was achieved when DDT was given 3 days prior to malathion. In other experiments chicks were exposed to 0, 50, 100, 150, 200 or 250 mg DDT/kg and exposed to malathion after a 3 day period. Maximum protection was attained at the 200 mg/kg dose level. Pretreatment with DDT increased the mean toxicity of malathion for chicks, from 281.80 mg/kg to 467.70 mg/kg. DDT pretreatment significantly reduced inhibition of cholinesterase activity in the blood and brain.

79-3048. Grover, I. S.; Tyagi, P. S. (Dep. Biol., Guru Nanak Dev Univ., Amirtsar 143005, India) **Induction of chlorophyll mutants by some common pesticides.** *Indian J. Exp. Biol.* 17(6): 609-611; 1979 (9 references).

Barley grains were soaked in water and then exposed to 0.025, 0.05, and 0.1% concentrations of thiodan (endosulfan), lebaycid (fenthion), kitazin (IBP), and folithion (fenitrothion). Tigrina was the most frequent mutant type produced. The pesticide that caused the greatest number of mutant types was thiodan. The genetic effects of the pesticides generally decreased with increasing doses and duration of exposure, except in the case of lebaycid.

79-3049. Srihari, K.; Sridhara, S. (Dep. Vertebr. Biol., Univ. Agric. Sci., Bangalore, India) **Haematological changes as a consequence of rodenticide treatment in a rat and gerbil.** *Indian J. Physiol. Pharmacol.* 22(2): 196; 1978.

Bandicota bengalenis rats and *Tatera indica* gerbils were given sublethal quantities of zinc phosphide and vacor to determine the effects of these pesticides on hematological parameters. Zinc phosphide increased red blood cell (RBC) counts in both sexes of the gerbils while in

the males a change was noted only in the WBC counts. In rats, zinc phosphide caused changes in the RBC. In female rats and male gerbils, the WBC differential was altered by zinc phosphide. Vacor increased platelet counts and zinc phosphide decreased them in the bandicots. In gerbils, vacor affected the platelet count in the males only. Different susceptibilities to the two rodenticides of the two species is suspected and the sex of the animals is considered to be a factor in the toxicological effects noted.

79-3050. Braginskii, L. P.; Beskaravainaia, V. D.; Shcherban', E. P. (Inst. Hydrobiol., Kiev, USSR) **Reaktsii presnovodnogo fito- i zooplanktona na vozdeistvie pestitsidov. [Response of freshwater phyto- and zooplankton to pesticides.]** *Izv. Akad. Nauk SSSR Ser. Biol.* (4): 599-606; 1979 (21 references) (Russian).

Various aspects of the responses of freshwater phyto- and zooplankton to pesticides are reviewed. The effect of pesticides on these organisms depends upon the concentration at different temperatures. At water temperatures above 17°C, pesticides were noted to affect the population structures. Zooplankton species were suppressed at concentrations of 0.01-0.1 mg/l. Succeeding generations were more sensitive to low pesticide concentrations than the parent strains. At concentrations of 1-10 mg/l phytoplankton were adversely affected. It is suggested that phytoplankton have buffering capabilities which increases their resistence to pesticidal pollution.

79-3051. Mumby, S. M.; Hammock, B. D.*; Sparks, T. C.; Ota, K. (Div. Toxicol. & Physiol., Dep. Entomol., Univ. California, Riverside, CA 92521) **Synthesis and bioassay of carbamate inhibitors of the juvenile hormone hydrolyzing esterases from the housefly, *Musca domestica.*** *J. Agric. Food Chem.* 27(4): 763-765; 1979 (31 references).

Twenty *N*-alkyl carbamate derivatives of geranyl phenyl ethers were synthesized and tested for juvenile hormone and anti-juvenile hormone activity against *Oncopeltus fasciatus, Lygus lineolaris, Trichoplusia ni, Tenebrio molitor, Culex pipens quinquefasciatus,* and *Musca domestica.* Low juvenile hormone-like activity was found on only the Diptera. The compounds were also assayed as inhibitors of the esterases which hydrolyze juvenile hormone in *Blaberus giganteus, T. ni,* and *M. domestica.* Negligible inhibition of *B. giganteus* and *T. ni* esterases was found, but the meta-substituted carbamates proved to be very potent inhibitors of *M. domestica* juvenile hormone esterases, as were some *N*-alkyl carbamates of 1-naphthol. (Author abstract reprinted by permission of the American Chemical Society.)

79-3052. Glickman, A. H.; Shono, T.; Casida, J. E.; Lech, J. J.* (Dep. Pharmacol. & Toxicol., Med. Coll. Wisconsin, Milwaukee, WI 53226) ***In vitro* metabolism of permethrin isomers by carp and rainbow trout liver microsomes.** *J. Agric. Food Chem.* 27(5): 1038-1041; 1979 (16 references).

Carp liver microsome esterases hydrolyze *trans*-permethrin much more extensively than *cis*-permethrin and the same relationship holds for rainbow trout liver microsomes, although they appear to be less active. There is a strong preference with both isomers and microsomal mixed-function oxidases of both species for hydroxylation at the 4' position of the alcohol moiety as opposed to other sites. The methyl group *trans* to the carboxy is usually hydroxylated more extensively than the *cis*-methyl group, the greatest specificity being with carp microsomes acting on *cis*-permethrin. The bile of rainbow trout exposed *in vivo* to [^{14}C]-alcohol-labeled *trans*-permethrin contains little or no permethrin but instead consists mainly of conjugates cleaved by β-glucuronidase but not by aryl sulfatase. (Author abstract reprinted by permission of the American Chemical Society.)

79-3053. Isensee, A. R.; Jones, G. E.; McCann, J. A.; Pitcher, F. G. (Pestic. Degrad. Lab., Sci. & Educ. Adm., ARS, USDA, Beltsville, MD 20705) **Toxicity and fate of nine toxaphene fractions in an aquatic model ecosystem.** *J. Agric. Food Chem.* 27(5): 1041-1046; 1979 (13 references).

The acute toxicity (96 hr LC50) of nine toxaphene fractions to bluegill fish (*Lepomic macrochirus*) varied from 2.6 to 29.0 μg/l (5.0 to 7.8 μg/l for unfractionated toxaphene). Bluegill fish, snails (*Helisoma* sp.), daphnids (*Daphnia magna*), and algae (*Oedogonium cardiacum*) were exposed to two water concentrations of unfractionated toxaphene and three of its fractions (representative of different toxicities) for 1-32 days in aquatic model ecosystems. Only slight differences were observed between the three fractions and unfractionated toxaphene in total amounts accumulated by each species. Bioaccumulation potential for bluegill fish was much higher than for snails (average of 6000 vs. 480 times water content, respectively). Thin-layer chromatographic analysis of fish and snail extracts taken after 3, 15, and 32 days of exposure indicated considerable metabolism by snails of all compounds but little metabolism by fish. (Author abstract reprinted by permission of the American Chemical Society.)

79-3054. Davidonis, G. H.; Arjmand, M.; Hamilton, R. H.; Mumma, R. O.* (Pestic. Res. Lab., Pennsylvania State Univ., University Park, PA 16802) **Biological properties of amino acid conjugates of 2,4,5-trichlorophenoxyacetic acid.** *J. Agric. Food Chem.* 27(5): 1086-1088; 1979 (8 references).

The effect of L-amino acid conjugates of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) on cell elongation of *Avena sativa* coleoptile sections and on growth of soybean

root callus tissue cultures has been evaluated at concentrations of 10^{-4} to 10^{-8} *M*. Most of the conjugates gave good stimulation of elongation in the *Avena sativa* test and were equivalent to the stimulation observed for 2,4,5-T. The most active 2,4,5-T conjugates based on their half-maximum concentrations were Val, Phe, Ile, Met, and Ala. In the soybean root callus tissue culture test 2,4,5-T and all conjugates gave stimulation of growth at low concentration and inhibition of growth at high concentration (10^{-4} *M*). The most active conjugates (Phe, Cys, Leu, Ala, Ser, Trp, and Ile) were statistically equivalent to the stimulation exhibited by 2,4,5-T. The Glu and Asp conjugates, which have been isolated as metabolites of 2,4,5-T in soybean root callus tissue, demonstrated poor biological activity. (Author abstract by permission of the American Chemical Society.)

79-3055. Slater, J. H.; Lovatt, D.; Weightman, A. J.; Senior, E.; Bull, A. T. (Dep. Environ. Sci., Univ. Warwick, Coventry CV4 7AL, England) **The growth of *Pseudomonas putida* on chlorinated aliphatic acids and its dehalogenase activity.** *J. Gen. Microbiol.* 114(1): 125-136; 1979 (29 references).

Studies were performed to determine the enzyme effects of monochloroacetic acid (MCA), dichloroacetic acid (DCA), trichloroacetic acid (TCA), 2-monochloropropionic acid (2MCPA), 3-monochloro proprionic acid (3MCPA), 2,2′-dichloro proprionic acid (22DCPA), 2,3- dichloroproprionic acid (23DCPA), 2-monochlorobutyric acid (2MCBA), 3-monochlorobutyric acid (2MCBA), and 4-monochlorobutyric acid (4MCBA). Strains S3 and P3 of *Pseudomonas putida* were grown in the presence of those compounds in a continuous-flow system. Chloride ion estimation, dehalogenase activity, and thermal stability of dehalogenase activity were determined. The addition of 0.5 g Cl^{-1} 2MCPA to P3 reduced the growth rate, but 22DCPA at the same concentration had no effect. When MCA and DCA were added to strain P3 at 0.5 g Cl^{-1}, there was an immediate decrease in growth rate; however, the culture exposed to MCA recovered within a short time. Dehalogenase activity varied with each acid. 3MCPA and 4MCBA completely stopped activity in strain P3. In crude extracts the pH had a definite effect on dehalogenase activity, with pH 7.9 to 8.1 being optional. The apparent K_m values were at the millimolar level for MCA, DCA, 2MCPA and 22DCPA.

79-3056. Phillips, G. R.; Buhler, D. R. (Coop. Fish. Res. Unit., Montana State Univ., Bozeman, MT 59717) **Influences of dieldrin on the growth and body composition of fingerling rainbow trout (*Salmo gairdneri*) fed Oregon moist pellets or tubificid worms (*Tubifex* sp.).** *J. Fish. Res. Board Can.* 36(1): 77-80; 1979 (25 references).

Fingerling rainbow trout (*Salmo gairdneri*) fed tubificid worms (*Tubifex* sp.) grew faster than those fed Oregon Moist Pellets (OMP) over a similar range of rations. Faster growth resulted because trout incorporated protein and fat from tubificids more efficiently than from OMP. Exposure to a sublethal concentration of dieldrin in water (0.18 μg/l) did not affect the protein elaboration of trout fed either diet or fat metabolism in trout fed OMP. However, dieldrin reduced fat elaboration in trout fed tubificids. The dieldrin concentrations in trout exposed to dieldrin in water increased as feeding level (and therefore body fat) increased. The different responses to dieldrin by fish fed these two diets provides evidence that the diet offered to fish can significantly influence the outcome of chronic toxicity tests. (Author abstract by permission)

79-3057. Veith, G. D.; DeFoe, D. L.; Bergstedt, B. V. (Environ. Res. Lab., US EPA, Duluth, MN 55804) **Measuring and estimating the bioconcentration factor of chemicals in fish.** *J. Fish. Res. Board Can.* 36(9): 1040-1048; 1979 (23 references).

A method of estimating the bioconcentration factor of organic chemicals in fathead minnows (*Pimephales promelas*) is described. Water at 25°C was intermittently dosed with the chemical at a nontoxic concentration in a flow-through aquarium. Thirty minnows are placed in the aquarium, and composite samples of five fish are removed for analysis after 2, 4, 8, 16, 24, and 32 days of exposure. The bioconcentration process is summarized by using the first-order uptake model, and the steady-state bioconcentration factor is calculated from the 32 day exposure. A structure-activity correlation between the bioconcentration factor (BCF) and the *n*- octanyl/ water partition coefficient (*P*) of individual chemicals is summarized by the equation $\log BCF = 0.85 \log P - 0.70$, which permits the estimation of the bioconcentration factor of chemicals to within 60% before laboratory testing. The facilities and resources for testing need be used only for those chemicals that are likely to result in substantial bioconcentration in organisms. The bioconcentration factors derived from tests of mixtures of chemicals are shown to be the same as those derived from tests with the chemicals individually. (Author abstract by permission)

79-3058. Reuber, M. D.; Ward, J. M. (Chem. Carcinog. Program, Frederick Cancer Res. Cent., NCI, Frederick, MD 21701) **Histopathology of liver carcinomas in (C57BL/6N x C3H/HeN) F_1 mice ingesting chlordane.** *J. Natl. Cancer Inst.* 63(1): 89-92; 1979 (25 references).

Effects of chlordane on the liver were studied in (C57BL/6N x C3H/HeN) F_1 male mice ingesting 30 or 56 ppm chlordane and in female mice ingesting 30 or 64 ppm chlordane in their diet. The mice were fed the chlordane diets for 80 wk, then received the basal diet without chlordane for an additional 10 or 11 wk. Necropsies and complete histological examinations were carried out. Liver carcinomas occurred in 91% of the male and 79% of the

female mice ingesting the high dose, and in 50% of the male and 14% of the female mice given the low dose. By comparison, 17% of the control males and 5% of the control females developed liver carcinomas. The carcinomas were predominantly hepatocellular, ranging from undifferentiated to well differentiated. In general, the carcinomas in controls were better differentated than those in treated mice. The carcinomas were capable of invasion and metastasis.

79-3059. Banerjee, S.; Van Duuren, B. L. (Lab. Org. Chem. & Carcinog., Inst. Environ. Med., Med. Cent., New York Univ., New York, NY 10016) **Binding of carcinogenic halogenated hydrocarbons to cell macromolecules.** *J. Natl. Cancer Inst.* 63(3): 707-711; 1979 (26 references).

A study was performed on the binding of carcinogens to microsomes and nucleic acids. Microsomal preparations from stomachs and livers of 7-10 wk old mice (B6C3F) and Osborne-Mendel rats were incubated with 250 nmoles (^{14}C) ethylene dibromide (EDB) or 1.04 μmoles ethylene dichloride (EDC). Salmon sperm DNA was incubated with either 250, 350, 500 or 750 nmoles of (^{14}C) EDB. There was a gradual increase in binding of EDB to microsomes and DNA, reaching maximum levels in 60 min. When the microsomal proten was denatured, or when microsomes were not present during the DNA binding studies, binding did not occur. As the microsome concentration was increased, the binding increased. There is evidence that metabolic activation of both EDB and EDC occurs before dividing occurs. Microsomes and DNA of Osborne rats, which are not susceptible to liver tumor induction by EDC, showed less binding by EDC than did the mice, which are susceptible. It is suggested that EDC and EDB are indirect carcinogens and must be activated, or transformed to an intermediate product before their effects are seen.

79-3060. Hinkle, D. K.; Suggs, J. E.; Jackson, M. D. (Environ. Biol. Div., Health Effects Res. Lab., US EPA, Research Triangle Park, NC 27711) **Environmental and biological effects of propoxur-impregnated strips within a laboratory animal room.** *Lab. Anim. Sci.* 29(4): 466-468; 1979 (5 references).

Sprague-Dawley rats were exposed to strips impregnated with propoxur hung in the laboratory animal room. Analysis of the air in the room indicated that there was less than 1 μg propoxur/m^3 air. These levels are below the human olfactory sensitivity level. An unexplained decrease was noted in the enzyme activity in female rat blood samples on the 7th day, but otherwise the acetylcholinesterase activity in either sex was not altered by the exposure.

79-3061. Thuranszky, K. (Heavy Metal Res. Inst., Veszprem, Hungary) **A toxikologia szerepe a novenyvedoszer-kutatasban, -gyartasban es -felhasznalasban. [Role of toxicology in the research, manufacture, and application of pesticides.]** *Magy. Kem. Lapja* 34(3): 113-118; 1979 (Hungarian).

The toxicological studies followed in connection with the development of new pesticides are outlined. As a first step, proposed compounds with an unfavorable ratio between effectiveness and toxicity are eliminated. The human toxicological studies include animal experiments to determine the general toxicological, carcinogenic, and teratogenic properties of the compound and the study of its metabolism in the organism. Along with studies on persistence, translocation, and degradation of the compound, the testing costs of a marketable and exportable compound are examined.

79-3062. Majewski, T.; Rzaczynski, B.; Podgorski, W.; Polonis, A.; Bialkowski, Z.; Tyczkowski, J. (Inst. Nutr., Akad. Roln, Lublin, Poland) **Wplyw dichlorofosu na niektore wskazniki biochemiczne krwi bydla. [Effect of dichlorvos on some biochemical indexes of cattle blood.]** *Med. Weter.* 35(1): 52-54; 1979 (17 references) (Polish).

The effects of DDVP (dichlorvos) vapor and skin application of DDVP were investigated on the biochemical parameters of cattle blood. Vapor effects were studied after the application of a 1.0% water emulsion at a dose of 0.5 g/m^2 to the walls and ceilings of the cattle barn at three day intervals. The effects of skin contact were studied after spraying the animals with a 1.0% water emulsion of DDVP; each animal was exposed to 0.75 g of the active ingredient. During the experiments, air temperature ranged from 15.4 to 25.6°C and humidity ranged from 70 to 90%. No significant clinical disturbances were revealed. There were some disturbances in hematological and biochemical indices in treated groups when compared with controls. There were disturbances in the number of resistance of red blood cells, the number of leukocytes, hemoglobin content, total protein, level of cholesterol, and activity of AlAT, AspAT, and ChE. The disturbances were more pronounced in cattle exposed to the DDVP vapors.

79-3063. Lijinsky, W.; Andrews, A. W. (Chem. Carcinog. Program, Frederick Cancer Res. Cent., NCI, Frederick, MD 21701) **The mutagenicity of nitrosamides in *Salmonella typhimurium*.** *Mutat. Res.* 68(1): 1-8; 1979 (10 references).

Thirty-four nitrosamides (10 nitroso alkyl carbamates, 2 nitroso alkyl nitro guanidines, 12 nitroso alkyl ureas, 6 substituted nitroso alkyl ureas, and 4 cyclic nitroso alkyl ureas) were tested for mutagenicity in *Salmonella typhimurium*. All the nitrosamides tested were direct-acting and mutagenic in strain TA1535 of *S. typhimurium* with the single exception of nitrosophenylurea; its

mutagenicity was best demonstrated with strain TA1537. Nitroso ethyl urethane was the only nitroso alkyl carbamate that was linearly mutagenic. All other chemicals tested were direct acting mutagens of varying potency. (Author abstract by permission)

79-3064. Zdzienicka, M.; Zielenska, M.; Tudek, B.; Szymczyk, T. (Dep. Biochem., Waswaw Med. Sch., P-02097 Warsaw, Poland) **Mutagenic activity of thiram in Ames tester strains of *Salmonella typhimurium*.** *Mutat. Res.* 68(1): 9-13; 1979 (10 references).

The mutagenic activity of thiram was investigated in 4 histidine-requiring strains of *Salmonella typhimurium* (TA1535, TA100, TA1538, TA98) with and without activation by liver microsomes. In strains TA1535 and TA100, thiram induces mutations without metabolic activation. The presence of rat liver microsome fraction, cysteine or glutathione abolish its mutagenic activity in these strains. In contrast, thiram requires metabolic activation for the expression of its mutagenic activity in TA1538 and TA98 strains. The compounds containing the sulfhydryl group abolish mutagenic activity of thiram in these strains, too. (Author abstract by permission)

79-3065. Chapman, R. B.; Penman, D. R. (Dep. Entomol., Lincoln Coll., Canterbury, New Zealand) **Negatively correlated cross-resistance to a synthetic pyrethroid in organophosphorus-resistant *Tetranychus urticae*.** *Nature (London)* 281(5729): 298-299; 1979 (8 references).

Spider mites are serious pests of food and fiber crops and often cause considerable reductions in yields. Control is usually by regularly spraying chemicals, but frequently this approach has led to the development of resistance to these chemicals and ultimately to reduced levels of control. Most species of tetranychid mites of agricultural significance can develop resistance to many organophosphorus insecticides, some organochlorine and carbamate insecticides and various other compounds. Cross-resistance, where resistance to one compound confers resistance to other compounds of the same group, and multiple resistance, where resistance has developed to compounds from a number of structurally different groups, are also known to occur. Occasionally the development of resistance to one compound will have the reverse effect by making a population more susceptible to a newly introduced compounds. This effect, termed negatively correlated cross-resistance, could have significant practical advantage in restoring some degree of susceptibility in a pest population. In this letter were describe an example of this phenomenon in spider mites in which resistance to organophosphates was linked with increased susceptibility to synthetic pyrethroids. (Author abstract by permission)

79-3066. Publicover, S. J.; Duncan, C. J. (Dep. Zool., Univ. Liverpool, Liverpool L69 3BX, England) **The action of lindane in accelerating the spontaneous release of transmitter at the frog neuromuscular junction.** *Naunyn-Schmiedebergs Arch. Pharmacol.* 308(2): 179-182; 1979 (25 references).

Studies were performed to determine the effect of the pesticide lindane on the biochemical activity of the neuromuscular junction of frogs. Miniature endplate potentials (MEPP) were determined by electrophysiological recordings to assess the spontaneous release of transmitters at the neuromuscular junction. Lindane was added to the saline solution bathing the isolated muscles. Concentrations of lindane ranging from $5 \times 10^{-6} M$ to $5 \times 10^{-4} M$ were tested. Concentrations of $5 \times 10^{-5} M$ caused a rise in MEPP frequency. Increased Ca^{2+} permeability and a rise of Ca^{2+} entry appear to be the primary mode of action of lindane. Lindane might also promote the release of Ca^{2+} from intracellular storage. Although the low level release of transmitters at the neuromuscular junction *in vivo* is not critical, if it occurred at synapses of the CNS it would apparently increase excitability.

79-3067. van Raalte, H. G. S. (Author address not given) **Behandeling van intoxicatie met landbouwgiffen. [Treatment of pesticide poisoning.]** *Ned. Tijdschr. Geneeskd.* 123(22): 921-927; 1979 (34 references) (Dutch).

The general principles and practical aspects of the treatment of pesticide poisoning are described. The antidotes used include neutralizing antidotes used to bind non-resorbed poison (e.g., activated carbon), pharmacological antagonists (e.g., atropine in organophosphate poisoning), and specific antidotes (e.g., oximes in organophosphate poisoning). Atropine and oxime are essential in the treatment of poisonings with acetylcholinesterase inhibitors. Such patients are characterized by remarkably high atropine tolerance. Some experts prefer β-receptor blockers, e.g., propranolol, to atropine in cyanotic patients. Acute poisoning by organochlorine pesticides requires anticonvulsive treatment with barbiturates or diazepam. Such patients have a remarkably high tolerance to barbiturates.

79-3068. Reuber, M. D. (Frederick Cancer Res. Cent., NCI, Frederick, MD 21701) **Carcinomas of the liver in rats ingesting Kepone.** *Neoplasma* 26(2): 231-235; 1979 (28 references).

A study was performed to determine the effects of Kepone (chlordecone) on the number of carcinomas appearing in rat liver. Young ablino male and female rats were fed Kepone at 0, 5, 10, 25, 50 or 80 ppm for 2 yr in one study and 0 or 1 ppm for 2 yr in another study. Eighty and 50 ppm doses caused severe muscle tremors within 2 wk. After 13 wk, 25 ppm caused tremors. Controls had no carcinomas; 5 ppm caused an incidence of 19%; 10 ppm,

53%; and 25 ppm, 40%. One in 17 females and one in 14 males ingesting 1 ppm developed early carcinomas. Some neoplasms were seen in reproductive and endocrine systems. Female rats were more susceptible to hepatic carcinogenesis than male rats.

79-3069. de Torrente, A.; Rumack, B. H.*; Blair, D. T.; Anderson, R. J. (Div. Renal Dis., Med. Cent., Univ. Colorado, Denver, CO 80262) **Fixed-bed uncoated charcoal hemoperfusion in the treatment of intoxications: animal and patient studies.** *Nephron* 24(2): 71-77; 1979 (37 references).

Two patients who had been exposed to insecticides agreed to submit to testing a fixed-bed uncoated charcoal device to be used in hemoperfusion. One male, aged 35, had been exposed to chlordane. The other patient, a 5-yr-old boy, was exposed to fluoroacetamide. A significant improvement was noted in the chlordane-intoxicated patient. No improvement was noted in the other case. It is suggested tht charcoal hemoperfusion may be useful in treating patients poisoned with chemicals characterized by an apparent volume of distribution smaller than total body water.

79-3070. Sanborn, G. E.; Selhorst, J. B.*; Calabrese, V. P.; Taylor, J. R. (Dep. Neurol., Med. Coll. Virginia, Richmond, VA 23298) **Pseudotumor cerebri and insecticide intoxication.** *Neurology* 29(9 pt. 1): 1222-1227; 1979 (22 references).

Three male patients, aged 20, 23 and 35 yr, suffered with pseudotumor cerebri and their histories showed evidence of chronic intoxication by the pesticide chlordecone (Kepone) following industrial overexposure. These three patients were among 23 previously reported employees who showed persistent signs and symptoms of intoxication and blood chlordecone levels greater than 2000 ng/ml. Contact was via dermal, respiratory and oral routes. Each of these three patients was obese, which may be significant in that this insecticide is stored in fat.

79-3071. Yano, H. (Dep. Public Health, Fac. Med., Kobe Univ., Kobe, Japan) **[Studies on health effects of chemical products through environmental pollution levels. Part. 2. Studies on accumulation of chemical products, easily accumulation (sic) in fish, to mammals.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 34(2): 437-443; 1979 (13 references) (Japanese).

BHT (2,6-di-tert-butyl hydroxy toluene), *p*-dichlorobenzene (DCB), 1,3,5-trichlorobenzene (TCB), hexachlorobenzene (HCB), and TCDAM (2,2′,3,3′-tetrachloro diamino diphenyl methane have been shown to accumulate readily in fish and resist decomposition by bacteria. The metabolism of these 5 compounds in mice was investigated with the aid of gas chromatography mass spectrometry. BHT was poorly absorbed by mice and was accumulated at a rate of 0.02%. DCB and TCB were absorbed at rates of 11 ± 2.9% and 50 ± 7.8%, respectively. Neither compound accumulated within 35 days when given orally to mice. HCB was accumulated in mice in amounts which agreed with theoretical values. The absorption rate of HCB was 38 ± 3.3%. No TCDAM was accumulated in mice after oral dosing. The absorption rate of TCDAM was 8.0 ± 1.7%. It is suggested that the accumulation factors of these five compounds in mammals be considered when evaluating their health effects in man.

79-3072. Matsushita, T.; Aoyama, K. (Sch. Hyg., Fac. Med., Kagoshima Univ., Kagoshima, Japan) **[Examination on cross sensitivity between benomyl and other major pesticides in hypersensitive contact dermatitis.]** *Nippon Noson Igakkai Zasshi (Jpn. J. Rural Med.)* 28(3): 464-465; 1979 (Japanese).

Pesticides which show cross reactions or contact hypersensitive dermatitis with benomyl were studied. Results of patch tests in humans indicate a relatively high positive reaction to benomyl in persons who usually use methomyl, chlotothalonil, dichlorvos, trichlorfon, IBP, dicofol, supracide, diquat, simazine, benthiocarb or captafol. Results of maximization tests in guinea pigs, using the above-mentioned pesticides vs. benomyl, showed a cross sensitivity between benomyl and other pesticides. This cross reactivity is relatively weak and has low frequency.

79-3073. Yatomi, T.; Ueda, K.; Kawai, M. (Sch. Hyg. Oral Cavity, Fac. Dent., Showa Univ., Tokyo, Japan) **[Studies on delayed neurotoxicity of organophosphorus pesticides. Part 4.]** *Nippon Noson Igakkai Zasshi (Jpn. J. Rural Med.)* 28(3): 468-469; 1979 (2 references) (Japanese).

The delayed neurotoxicities of leptophos and its derivatives on adult, female, white Leghorn chickens were examined. The birds were force fed doses of 1 mg/kg and observed for a period of 21 days. Delayed neurotoxicity was noted in birds receiving 6 of the derivatives. The degree of toxicity depended upon the substitution patterns of the derivatives. With two compounds delayed neurotoxicity was not observed.

79-3074. Suenaga, M.; Akiba, T.; Nakagawa, S.; Shoji, T.; Sasaoka, T.; Yoshida, K.; Asano, Y. (Sch. Intern. Med. 2, Tokyo Dent. & Med. Univ., Tokyo, Japan) **[Effectiveness of treatment with direct hemoperfusion using activated carbon column on paraquat intoxication.]** *Nippon Noson Igakkai Zasshi (Jpn. J. Rural Med.)* 28(3): 474-475; 1979 (Japanese).

Activated carbon beads derived from petroleum pitch were doubly coated with poly(HEMA) and then used to fill a column up to 160 g. When used at a rate of 100 ml/min at 37°C for the *in vitro* perfusion of dogs blood containing 100 mg paraquat/1000 ml, the paraquat concentration in the blood was 50 mg/l after 5 min and was not detectable after 1 hr. When used for treating 9 cases of paraquat intoxication, the success of the column depended on the amount of paraquat initially ingested. When the amounts of 24% paraquat ingested were 10 ml or less, the patients survived. The efficiency of the method also depended on beginning the perfusion before signs of pulmonary edema were present. The direct blood perfusion using this type of activated carbon bead column is judged to be effective in cases where the amounts of paraquat ingested are not greater than 15 ml, when perfusion is started within 8 hr of ingestion, and when the patient does not show signs of pulmonary edema.

79-3075. Rao, P. N.; Rao, J. P. (Div. Bot., Andhra Pradesh Agric. Univ., Andhra Pradesh, India) **Effect of pre-sowing soaking of cotton seed in systemic chemical on germination and bacterial blight incidence.** *Pesticides* 13(6): 53; 1979 (2 references).

In order to test the effectiveness of pre-sowing seed treatments on the germination of cotton seeds and the incidence of bacterial blight, seeds were soaked in prepared solutions of the systemic bactericides, Agrimycin 100, Agrimycin 500, and Streptocyline (100 ppm), and the systemic bactericide, Plantvax (10,000 ppm; oxycarboxin) for 8-12 hr. After sowing, germination counts were taken on the 5th, 10th, and 15th day, and the incidence of bacterial blight was calculated after spraying the fields with bacterial suspension of *Xanthomonas maylacearum* E. C. Smith prepared from blight-infected leaves. Treatment of the seeds with Plantvax for 12 hr was more effective in reducing the incidence of blight than the same treatment for 8 hr. However, the 12 hr treatment with Plantvax delayed germination when the seeds were sown. Treatment of seeds in Agrimycin 500 for 12 hr only slightly affected germination. The incidence of blight was the lowest for seeds soaked in Agrimycin 100 for 12 hr, with no inhibition of germination. This latter treatment was suggested for use as the preferred pre-soak method for controlling bacterial blight in cotton.

79-3076. Starkus, J. G.; Narahashi, T.* (Dep. Pharmacol., Med. Sch., Northwestern Univ., Chicago, IL 60611) **Temperature dependence of allethrin-induced repetitive discharges in nerves.** *Pestic. Biochem. Physiol.* 9(3): 225-230; 1978 (14 references).

Giant axons from the squid, *Loligo pealei*, were mounted in a Plexiglas chamber, and an internal electrode complex was inserted longitudinally to measure internal potential. A platinum wire was used to deliver stimulating currents. The axon was exposed to allethrin. There appeared to be an optimal temperature range at which repetitive discharges were induced by a single stimulus in the allethrin-poisoned giant squid axon. The resting potential, negative after-potential, and threshold number potential change in amplitude with the temperature and repetitive responses are induced when the negative after-potential exceeded the level of the threshold membrane potential. This condition was met at temperatures ranging from 20-28°C.

79-3077. Kendall, R. J.; Noblet, R.; Senn, L. H.; Holman, J. R. (Dep. Entomol. & Econ. Zool., Clemson Univ., Clemson, SC 29631) **Toxicological studies with mirex in bobwhite quail.** *Poult. Sci.* 57(6): 1539-1545; 1978 (18 references).

Bobwhite quail (*Colinus virginianus*) received dietary mirex in concentrations of 1, 20, and 40 ppm to investigate reproductive effects of long term exposure to this chemical. Residue analyses of F_0 generation breeders indicated that male adipose tissue contained approximately 10 times the mirex level in the diet. Elimination of mirex in females probably was facilitated by egg laying, which reduced mirex buildup in adipose tissue to five times the dietary level. Both sexes were noted to concentrate mirex in fat and breast tissue in direct proportion to the intake of dietary mirex. Eggs collected from F_0 generation breeders were not affected deleteriously by mirex as measured by embryo survival to 3 wk, and the number of eggs failing to hatch. Increased rates of egg fertility and hatchability were associated with higher dietary concentrations. Chick survival data was obtained in F_0 and F_1 generation hatchlings from hatching through 2 wk. No chick mortality attributable to pesticide stress was detected in either group of birds. Eggs collected from F_1 generation breeders that received 1 ppm were not affected harmfully as measured by embryonation, embryo survival, and hatchability rates. Comparison of residues in wild bobwhites with residues in the range of our experimental findings indicates mirex is apparently not deleteriously affecting reproductive success of wild quail. (Author abstract by permission)

79-3078. Schom, C. B.; Abbott, U. K.; Walker, N. E. (Dep. Biol. Sci., Brock Univ., St. Catharines, Ontario L2S 3A1, Canada) **Adult and embryo responses to organophosphate pesticide: azodrin.** *Poult. Sci.* 58(1): 60-66; 1979 (13 references).

Azodrin was applied to adult and embryo chickens, chukar partridge, and bobwhite quail. Chronic exposure of adult birds to azodrin mixed in their feed indicated that no *a priori* predictions could be made about one species based on the results of another; each had a different no effect (MACT) level. The chickens were between 25 and 100 ppm, the chukar partridge 5 and 25 ppm, and the bobwhite quail less than 1.25 ppm. The chicken adults

were most resistant, and the quail were least resistant to chronic exposure to azodrin. Yolk-injected azodrin caused the embryos of all three species to develop abnormally. The chicken and chukar embryos developed a generalized achondroplasia, the quail were amuscular, only. In general, the 3 day quail embryos were most resistant to injected azodrin and the chicken embryo least resistant. The relationship between adult and embryo response was negative. (Author abstract by permission)

79-3079. Hansen, L. G.; Dorn, S. B.; Beamer, P. D. (Div. Pharmacol. & Toxicol., Coll. Vet. Med., Univ. Illinois, Urbana, IL 61801) **Residues and effects from feeding high concentrations of hexachlorobenzene to broiler cockerels.** *Poult. Sci.* 58(1): 81-86; 1979 (10 references).

Eight-day old broiler cockerels received 0, 1, 10, or 100 ppm dietary hexachlorobenzene (HCB) for 25, 38, or 52 days. Treated birds grew faster for the first 25 days, but the trend was reversed at later times so there was no net weight difference at 52 days. Birds receiving 100 ppm dietary HCB had significantly enlarged adrenal glands at 38 days and enlarged livers at 38 and 52 days. Equilibirium concentrations in adipose tissue 12 to 13 times the dietary concentration were reached by 23 days in birds receiving 10 or 100 ppm HCB. Birds receiving 1 ppm concentrated HCB more effectively in the fat and did not reach equilibrium until 23 to 38 days. (Author abstract by permission)

79-3080. Selypes, A.; Paldy, A. (Inst. Hyg. & Epidemiol., Med. Univ., Szeged, Hungary) **The examination of the mutagenic effect of two pesticides: Krezonit E and Gramoxone.** *Proc. Hung. Ann. Meet. Biochem.* 18: 77-78; 1978.

Krezonit E, which contains 50% dinitro- *o*- cresol (DNOC), was shown to be mutagenic in human leukocyte culture tests, in mouse bone marrow preparations, and in other tests. In all systems the aberrations both in the somatic and in the gametic cells were detectable. The rate of both chromatid and chromosome type aberrations and the autosomal and XY univalents of the diakinesis phase of meiosis were significantly high. In the cultures of human leukocytes the number of chromatid type aberrations increased with increasing concentration of contaminant. It is suggested that this mutagenic effect arises during the metabolism of the chemical; the nitro group is formed into a hydrazo group which causes structural changes in the DNA. it. The mutagenic effect of paraquat (as Gramoxone) was not proved in this study.

79-3081. Parkas, I.; Desi, I. (Natl. Inst. Hyg., Budapest, Hungary) **Toxicology and environmental protection with special regard to neurotoxic pesticides.** *Proc. Hung. Ann. Meet. Biochem.* 18: 83-86; 1978 (7 references).

Inorganic lead and organophosphate pesticide poisonings result in peripheral neuropathy. Organic phosphate compounds cause late neuropathy independent from their effects on reducing cholinesterase activity. Organic mercury compounds cause poisoning both to the axon and the myelin. The neurotoxicity of about 20 pesticides, including lindane, trichlorfon, dichlorvos, bromophos, malathion and carbaryl, have been previously investigated and are generally reviewed. The toxicities of these chemicals have been assessed by both the psychophysiological and the EEG method.

79-3082. Matkovics, B.; Novak, R.; Szabo, L.; Ivan, J.; Mindszenty, L. (Biol. Isotop Lab., Attila Josef Univ., H-6701 Szeged, Hungary) **Some new data to the molecular mechanisms of organophosphate insecticides action.** *Proc. Hung. Annu. Meet. Biochem.* 18: 87; 1979.

The toxicities of trichlorfon and sumithion (fenitrothion) were tested on rats. In order to offset the effects caused by these organophsphates, vitamin A and E excesses were created in the animals. The cholinesterase decrease which resulted was not prevented by pretreatment with vitamins A or E. In each case examined, the organophosphatae elevated the superoxide dismutase activity and the lipid peroxidation values, although to different extents.

79-3083. Barabas, K.; Suveges, G. (Inst. Hyg., Med. Univ., Szeged, Hungary) **The effect of reductant substances on the toxicity of paraquat.** *Proc. Hung. Ann. Meet. Biochem.* 18: 95-96; 1978.

Mice were exposed to paraquat at varying dose levels and treated with ascorbinic acid and glutathione. Ascorbinic acid demonstrated a favorable effect on the survival of the animals. Daily administration of ascorbinic acid at levels of 15 mg/mouse proved effective. Changes in the lungs in these treated mice were were not as severe as changes in the non-treated mice. Glutathione was not as effective. Survival rates with the ascorbinic acid and glutathione were 80 and 60%, respectively. It is suggested that ascorbinic acid be used in the treatment of humans poisoned with paraquat to prevent harmful cell profileration in the lung.

79-3084. Du'ka, F.; Marton, A. F.; Komives, T.; Hulesch, A. (Cent. Res. Inst. Chem., Hungarian Acad. Sci., Budapest, Hungary) **Metabolism and mode of action of thiocarbamate herbicides.** *Proc. Hung. Ann. Meet. Biochem.* 18: 107-110; 1978 (12 references).

Thiocarbamates are effective as herbicides against annual grasses and broadleaf weeds. Thiocarbamates are

easily absorbed by both sensitive and resistant plants. The process involved in herbicide biotransformation is the metabolism of the chemical. Various routes are open to thiocarbamates for chemical or biochemical degradation including hydrolytic cleavage at the ester or amide linkage, hydroxylation of alkyl groups, oxidation of sulfur atoms and dealkylation reactions. These chemicals appear to alter normal plant metabolism in several ways: photosynthesis, respiration, oxidative phosphorylation, protein synthesis, and nucleic acid metabolism are changed. The relative importance of these factors to the toxicity of the herbicide is not yet known.

79-3085. Popenoe, D.; Loosli, C. G. (Dep. Pathol., Sch. Med., Univ. Southern California, Los Angeles, CA 90033) **The morphological effects of a single exposure of paraquat on the mouse lung.** *Proc. West. Pharmacol. Soc.* (21): 151-153; 1978 (4 references).

The morphological effects on the mouse lung of a single exposure to paraquat aerosol was investigated in 3-mo-old male BALBc mice. Four mice each were sacrificed at 6 hr, 1, 3, 6, and 16 days after exposure to 12 mg/ml paraquat aerosol. Mice sacrificed 6 hr after exposure showed mimimal inflammatory changes including cell injury of the bronchiolar epithelium. After one day the bronchiolar epithelium was necrotic and had sloughed into the lumen. By 16 days there was extensive fibroblast and type II pneumocyte proliferation within the interstitial space and within the alveolar lumen. A cystic appearance was produced by widely dialated alveoli and bronchioles separating the areas of fibrosis. The lesions are similar to those produced by other agents which damage pulmonary structures. Thus, paraquat poisoning can be a model for the study of connective tissue response found in a variety of pulmonary diseases.

79-3086. Lee, T. P.; Park, B. H. (Children's Hosp., State Univ. New York, Buffalo, NY 14214) **Biochemical basis of Aroclor 1254 and pesticide toxicity *in vitro*. 1. Effects on intracellular ATP concentration.** *Res. Commun. Chem. Pathol. Pharmacol.* 25(3): 597-605; 1979 (12 references).

The effects of Aroclor 1254 and *o,p'*-DDT on intracellular concentrations of ATP were investigated in human lymphocytes to elucidate the biochemical basis of chemical toxicity of pesticides. Lymphocyte suspensions exposed to 10^{-6} *M*, 3 x 10^{-6} *M*, and 10^{-5} *M* of Aroclor 1254 had decreased intracellular ATP concentrations in a dose dependent manner. DDT, which also inhibits lymphocyte mitogenic response to phytohemagglutin, decreased intracellular ATP concentration when the dose was 10^{-6} *M*. Aroclor 1254 also inhibited lactate production to a lesser degree. The inhibition of Aroclor 1254 on lymphocyte oxygen consumption was also determined and found to be both time and dose dependent. The extent of the inhibition of ATP and oxygen consumption are comparable suggesting that the inhibition of mitochondrial respiration is primarily responsible for decreased ATP concentration. Aroclor 1254 inhibited lymphocyte and monocyte oxygen consumption while neutrophils were not inhibited.

79-3087. Roth, J. A. (Dep. Pharmacol. & Therapeut., Sch. Med., State Univ. New York, Buffalo, NY 14214) **Use of the isolated perfused lung in biochemical toxicology.** *Rev. Biochem. Toxicol.* 1: 287-309; 1979 (103 references).

A review of the literature on the use of perfused lungs in determining biochemical toxicology is presented. This method can be used to determine the pulmonary disposition of agents administered either intratracheally or intravenously. Substances ranging from blood-borne vasoactive hormones to foreign substances ingested or inhaled can be tested. The Niemeier and Bingham and the Iwasawa and Gillis lung perfusion systems are described. The degradation of vasoactive amines, prostaglandins, and vasoactive peptides, angiotension I and bradykinin after the removal of lungs is presented. A review is also presented of the metabolic fate of parathion, carbaryl, aldrin, dieldrin, and benzpyrene. The vascular intimal endothelial cells appear to be the site of pulmonary detoxification. The authors concluded that this type of cell in other organs may also be a site of detoxification.

79-3088. Palut, D.; Cybulski, J. (Inst. Toxicol., State Inst. Hyg., P-00791 Warsaw, Poland) **Metylacja DNA przez metylobromfenwinfos ^{14}C w doswiadczeniach *in vitro* i *in vivo*. [DNA methylation by ^{14}C methylbromfenvinfos *in vivo* and *in vitro*.]** *Rocz. Panstw. Zakl. Hig.* 30(3): 285-292; 1979 (20 references) (Polish).

The *in vitro* DNA methylation by [^{14}C] methyl bromfen vinphos (MBF) and the *in vivo* methylation of nuclear DNA after ip injection of the insecticide (45 mg/kg) in rats were studied. The *in vitro* alkylation of DNA from calf thymus was slow and reached its maximum after 24 hr. *In vivo* the labeling of the nuclear DNA increased gradually with time after administration of MBF. The specific activities measured after 6, 12, and 24 hr were 55, 67.5, and 213 pCi/mg, respectively. The maximum radioactivity was observed after 120 hr (288 pCi/mg), and it remained at a fairly high level for 240 hr (153 pCi/mg). Both *in vivo* and *in vitro*, MBF yielded only 5% N^7-methylguanine, and the radioactivity was found mainly in N^3-methyladenine and O^6-methylguanine.

79-3089. Kanoh, S.; Ema, M.; Itami, T. (Dep. Pharmacol., Natl. Inst. Hyg. Sci., Osaka, Japan) **Studies on the relationship between fetal toxicity and maternal functions. 2. Effect of P-450.** *Teratology* 20(1): 172-173; 1979.

Fetal toxicity of drugs may be affected by induc-

tion of the microsomal drug metabolizing enzyme (P-450) induced with phenobarbital (PB) in pregnant rats. Pregnant rats injected with PB at various stages during gestation were administered Phosvel (leptophos), an organophosphorus insecticide. The content of P-450 in the maternal liver, placenta and fetal liver were measured. Maternal and fetal toxicity were also studied. No PB effects were observed on the mothers and fetuses at term. All rats died within 24 hr after oral administration of Phosvel (50 mg/kg), whereas most rats receiving Phosvel 24 hr after treatment with PB survived until term. The concent of P-450 was high in the maternal liver, but it was very low in the placenta and the fetal liver. The content of P-450 in the maternal liver was increased slightly by treatment with PB. During gestation, plasma cholinesterase activity was unchanged, but activity in the placenta was increased. Although cholinesterase activity was not affected by administration of PB, the decrease in activity by combined treatment with PB and Phosvel was less than with Phosvel alone. Postnatal growth of neonates from mothers receiving PB showed no significant differences compared with control offspring. From these data, it is concluded that P-450 may play an important role in the fetal toxicity of drugs. (Author abstract by permission)

79-3090. Grudzinska, E.; Lechowska-Postek, M.; Ilczuk, I.; Rump, S. (Mil. Inst. Hyg. & Epidemiol., Warsaw, Poland) **Comparison of the therapeutic effects of trimethadione and phensuximide in acute organophosphate intoxications.** *Ther. Hung.* 26(3): 119-123; 1978 (7 references).

The therapeutic value of Trimethadione in organophosphate poisonings was investigated and compared with the effectiveness of phensuximide. The antilethal and anticonvulsant effects and the effect on bioelectric activity of the cortex of the two substances were determined experimentally. Fluostigmine had an LD50 of 3.55 mg/kg, while phensuximide and trimethadione had LD50 levels of 484 and 2122 mg/kg, respectively. When anticonvulsants were given with atropine and obidoxime effectiveness was increased. Trimethadione and phensuximide increase the convulsive threshold for fluostigmine in mice. Trimethadione was more effective in preventing and ceasing the fluostigmine-induced spike activity in the rabbit cortex. Trimethadione was also more effective as an adjunct to atropine and obidoxime in the therapy of fluostigmine intoxication of mice. Thus, trimethadione may be of value in the treatment of organophosphate intoxications.

79-3091. Heinz, G. H.; Johnson, R. W. (Patuxent Wildl. Res. Cent., US Fish & Wildl. Serv., Laurel, MD 20811) **Elimination of endrin by mallard ducks.** *Toxicology* 12(3): 189-196; 1979 (19 references).

Mallard ducks, 1-yr-old, were fed a diet containing 20 ppm endrin. Eleven days later one of the ducks died and food consumption of the other ducks had fallen off. Endrin feeding was stopped after 13 days. Ducks were sacrificed at 2, 4, 8, 16, 32, and 64 days after they stopped receiving endrin. Birds which died from the endrin exposure experienced convulsions and all had levels of endrin in the brain which demonstrated endrin poisoning to be the cause of death. After endrin exposure was stopped, endrin concentrations diminished rapidly in the first 3 days, slowing after that time.

79-3092. Story, D. L.; Freedland, R. A. (Dep. Nutr. & Food Sci., Massachussetts Inst. Technol., Cambridge, MA 02139) **The effect of *o,p'*-DDT feeding and food deprivation on plasma and liver amino acids and liver serine dehydratase in rats.** *Toxicol. Appl. Pharmacol.* 50(2): 329-3345; 1979 (21 references).

The effects of DDT feeding and food deprivation on liver and plasma amino acid concentrations were studied. DDT feeding had no effect on plasma amino acids but resulted in an increase in the concentration of liver isoleucine, ornithine, phenylalanine, serine, and threonine. In rats that were fed the control or DDT for 2 wk and then deprived of food for 48 hr, the concentrations of liver isoleucine, phenylalanine, serine, and threonine were similar. The activity of liver serine dehydratase was decreased in hepatocytes from DDT-fed rats compared to fed controls. After food deprivation, the activity of serine deydratase was similar in hepatocytes from control and DDT-fed rats, which is consistent with the response of liver serine and threonine concentrations to DDT feeding. Gluconeogenesis from serine was determined in isolated hepatocytes from DDT and control-fed rats and it was found that rates of gluconeogenesis were not affected by DDT feeding. This would indicate that the activity of serine dehydratase is not limiting for gluconeogenesis from serine in hepatocytes from fed rats. (Author abstract by permission)

79-3093. Klaschka, F.; Nieding, G. V.; Walter, R. (Hautklin., Klinikum Steglitz, Frei Univ. Berlin, D-1000 Berlin, BRD) **Zur Frage der Hautsensibilisierung durch Pentachlorophenol (PCP)- haltige Holzschutzmittel. [Skin sensitization by PCP-based wood preservatives.]** *Zentralbl. Arbeitzmed. Arbeitzschutz* 29(6): 150-154; 1979 (20 references) (German).

Skin tests involving contact with 1 and 5% pure PCP, technical PCP and PCP-Na (sodium salt) were performed on 100 selected PCP-exposed individuals and a group of unselected control individuals. The PCP in some cases caused skin reactions in the form of contact dermatitis. These reactions were not always reproducible in the same individuals, and are thought to be due to the uncoupling of oxidative phosphorylation of cellulose

metabolism. For these reasons PCP can not be said to cause allergic reactions. Judged by the intensity and incidence of exposure, PCP can be characterized as a comparatively mild eczema-causing allergen.

See also 79-2857, 79-2858, 79-2866, 79-2871, 79-2873, 79-2876, 79-2892, 79-2894, 79-2898, 79-2899, 79-2911, 79-2951, 79-2957, 79-2960, 79-2963, 79-2966, *and* 79-2978.

79-3094. Daughton, C. G.; Cook, A. M.; Alexander, M.* (Lab. Soil Microbiol., Dep. Agron., Cornell Univ., Ithaca, NY 14853) **Gas chromatographic determination of phosphorus-containing pesticide metabolites via benzylation.** *Anal. Chem.* 51(12): 1949-1953; 1979 (12 references).

Mono- and di-protic alkyl and aryl phosphates, phosphonates, and thio analogs were determined in spiked samples of bacterial growth medium and human urine using a new procedure with a detection limit of less than 2 pmol each. The acids were fully protonated by passing the aqueous samples through BioRad AG 50W-X8 (H^+) resin and dried thoroughly before refluxing with 3-benzyl-1- *p*-tolyltriazene in acetone. The benzyl esters that formed partitioned quantitatively into cyclohexane and were determined by gas-liquid chromatography with a flame-photometric detector (phosphorus mode) and a glass column (5% OV-210 on 80/100 mesh Gas Chrom Q). Linear recovery curves were obtained. Inorganic *o*-phosphate did not interfere with urine analysis, although it could be easily removed by $Ca(OH)_2$ precipitation. (Author abstract reprinted by permission of the American Chemical Society.)

79-3095. Langhorst, M. L.; Nestrick, T. J. (Michigan Div. Anal. Lab., Dow Chem. Co ., Midland, MI 48640) **Determination of chlorobenzenes in air and biological samples by gas chromatography with photoionization detection.** *Anal. Chem.* 51(12): 2018-2025; 1979 (30 references).

Methods are described for the determination of chlorobenzenes (monochlorobenzene through hexachlorobenzene) at ppb levels in air and human urine and blood samples by gas chromatography with photoionization detection. Prior to analysis, chlorobenzenes in air are collected concentrated on XAD-2 resin, and solvent desorbed. The method for urine and blood samples consists of carbon tetrachloride extractions, silica gel column chromatography and concentration with a Kuderna-Danish concentrator. A specially designed column packing allows separation of the chlorobenzenes in 16 min. Data presented indicate that collection and desorption efficiencies for chlorobenzenes with concentrations between 5 ppb (v/v) and 15 ppm (v/v) in air to be 95 ± 12% (2 σ). Chlorobenzene recoveries from urine and blood samples are 83 ± 12% for concentration between 1 and 500 ppb (ng/g). (Author abstract reprinted by permission of the American Chemical Society.)

79-3096. Thio, A. P.; Kornet, M. J.; Tan, H. S. I.; Tompkins, D. H. (Div. Regulat. Serv., Univ. Kentucky, Lexington, KY 40506) **Alkylation of carboxylate salts of acidic herbicides for gas chromatographic analysis.** *Anal. Lett.* 12(A9): 1009-1017; 1979 (21 references).

An excess of both methyl iodide and anhydrous alkali metal carbonate was added to a solution of 2-methoxy- 3,6- dichloro benzoic acid and three phenoxyacetic acids in acetone to prepare the methyl esters of the acids. When cesium carbonate was used, the reaction was completed within the shortest period of time. Without further work-up the reaction mixture was injected into a gas chromatograph with a flame ionization detector. The reaction time was further reduced by heating the mixture to 50°C and by ultrasonic treatment. In similar experiments the methyl esters of 2,4-D and 2,4,5-T were formed and the butyl ester of 2,4-D was also obtained at better than 90% yield.

79-3097. Moye, H. A.; Boning, A. J., Jr. (Pestic. Res. Lab., Food Sci. & Human Nutr. Dep., Univ. Florida, Gainesville, FL 32611) **A verstaile fluorogenic labeling reagent for primary and secondary amines: 9-fluorenylmethyl chloroformate.** *Anal. Lett.* 12(B1): 25-35; 1979 (17 references).

A study was performed to develop a labeling process for primary and secondary amines. The compound 9-fluorenyl methyl chloroformate (FMOCCl) reacts rapidly under alkaline, aqueous conditions at the 9- fluorenyl methoxy carbaryl group. The original interest in this labeling compound was due to a need to derivatize the herbicide glyphosphate (GlyPH). A yield of 15% was obtained for a GlyPH-FMOCC1 reaction during macropreparation. When 10^{-5} *M* GlyPH was derivatized and compared via high performance liquid chromatography with dilutions of the macro-prep, a yield of 109% was obtained. The authors conclude that in this method partitioning eliminates the excess reagent; the method improves chromatographic resolution of amino acid like compounds and introduces a large quantum yield fluorophone that is not altered by solvent-solute interactions.

79-3098. Albro, P. W. (Environ. Biol. & Chem. Branch, NEIHS, Research Triangle Park, NC 27709) **Problems in analytic methodology: sample handling, extraction, and cleanup.** *Ann. NY Acad. Sci.* 320: 19-27; 1979 (15 references).

Problems encountered in analytical procedures dealing with sample handling, extraction and cleanup are reviewed. The water content of the sample matrix and the lipid content of different sample tissues are important factors to be considered during the extraction process. At present the cleanup procedures used consider one or more of the following four principles: chemical destruction of interfering substances with acid, alkali or oxidizing agents; liquid-liquid partition; absorption chromatography; or gel filtration. The paper considers briefly the effect of spiking solvent on the recovery of mirex from fish muscle, and the partition of DDT between hexane and a polar solvent in the presence or absence of lipid.

79-3099. Hass, J. R.; Friesen, M. D. (Environ. Biol. & Chem. Branch, NIEHS, Research Triangle Park, NC 27709) **Qualitative and quantitative methods for dioxin analysis.** *Ann. NY Acad. Sci.* 320: 28-42; 1979 (33 references).

Methods for determining the concentration of polychlorinated dibenzo- *p*- dioxins in biological/environmental samples are reviewed. The least expensive technique, electron capture gas chromatography, is not adequately sensitive or specific for dioxin analysis in biological samples. This sensitivity and specificity is improved by the use of mass spectrometry in combination with gas chromatography. Selective ionization techniques such as NCI improve the sensitivity, particularly in the areas of C^{14} to C^{16}.

79-3100. Crummett, W. B. (Anal. Lab., Dow Chem. Co., Midland, MI 48640) **The problem of measurements near the limit of detection.** *Ann. NY Acad. Sci.* 320: 43-47; 1979 (18 references).

The need for being able to measure trace contaminants in commercial products, in the workplace, and in the natural environment is stressed. Methods which are used to detect the presence of very small quantities of hazardous substances are often subject to error. The example of the suspected, but not proven, presence of TCDD in ronnel is offered. Questions dealing with proper methods of sampling, means of validating the method used, collaboration of the findings, limits of detection, and proof of identity are listed.

79-3101. Ayers, C. W. (Coop. Cent. Sci. Res. Rel. Tobacco, F-75340 Paris, France) **The determination of dithiocarbamate residues in tobacco.** *Beitr. Tabakforsch. Int.* 9(5): 289-296; 1978 (5 references).

Various methods for the determination of dithiocarbamate (DTC) pesticide residues in tobacco are described. Two analytical methods utilize decomposition of DTC by heating with acid to form carbon disulfide. In method A formic acid is used as the hydrolyzing agent; method B employs HCl and stannous chloride. Analyses are made by spectrophotometric measurements at 272, 302, and 322 nm using a 10 mm quartz cell. Method B generally gave better results (85-100% recovery yields as calibrated against known standard DTC solutions) than method A (recovery 70-90%).

79-3102. Gretch, F. M.; Barry, T. L.; Petzinger, G.; Geltman, J. (US FDA, Brooklyn, NY 11232) **Identification of the herbicide 2,4,6- trichloro phenyl- *p'*- nitrophenyl ether in imported rainbow trout.** *Bull. Environ. Contam. Toxicol.* 23(1-2): 165-169; 1979 (5 references).

A study is presented in which a sample of rainbow trout imported from Japan was examined by gas chromatography interfaced to double beam mass spectrometry. Low resolution GC-MS analysis of extracts determined the molecular weight (317) and number of chlorine atoms (3) of an unknown compound. A literature search of compounds with similar characteristics indicated the possibility of the unknown to be 2,4,6- trichloro phenyl- *p'*- nitrophenyl ether. Identification was confirmed using a reference standard provided by the manufacturer.

79-3103. Stein, V. B.; Pittman, K. A. (Inst. Comp. & Human Toxicol., Albany Med. Coll. Albany, NY 12208) **Gas-liquid chromatographic determination of mirex in plasma, liver and fat from mice and monkeys.** *Bull. Environ. Contam. Toxicol.* 23(3): 300-305; 1979 (11 references).

A rapid and sensitive method of mirex detection using small samples of plasma and tissue was developed. Up to 0.3 g of liver or fat were extracted with hexane and acetonitrile. Up to 0.5 ml of mouse plasma were extracted with hexane, and 1.0 ml of monkey plasma was extracted with acetonitrile. Florisil and sodium sulfate columns were used for clean-up. Elluates were analyzed by gas liquid chromatography. The methods described can also be used for the analysis of kidney, thyroid, gonads, adrenals, nerves and feces, with recoveries over 90%. In the studies presented here, recoveries ranged from 90 to 107% from mouse plasma, and 93 to 101% for monkey plasma. Liver tissue recovery was 94 to 102% for mice and 93 to 104% for monkeys. Fat extractions resulted in 90-102% recoveries for mice and 92-99% recoveries for monkeys. The method is sensitive to 0.01 ppm for plasma, 0.03 ppm for liver, and 0.017 ppm for fat.

79-3104. Wheeler, W. B.; Thompson, N. P.; Edelstein, R. L.; Krause, R. T. (Pestic. Res. Lab., Food Sci. & Human Nutr. Dep., Univ. Florida, Gainesville, FL 32611) **Comparison of blenders for the extraction of carbofuran from radishes.** *Bull. Environ. Contam. Toxicol.* 23(3): 387-390; 1979 (3 references).

A study was performed in which blenders were compared for their efficiency in the extraction of carbofuran from radishes. Three different blenders, a Polytron Ultrasonic Homogenizer, a Lourdes blender, and a Waring blender were used to homogenize samples of radishes treated with the pesticide. Extractions wre performed 3, 7, and 14 days after treatment. The 3-day sample was blended by all three models with equal efficiency. After 7 and 14 days, the Waring blender was significantly less efficient than the other two. From a practical viewpoint, the differences were not large. The least efficient blender extracted 90% of that extracted by the most efficient. It is concluded that no major analytical error would be introduced by the use of any of these blenders in pesticide analyses.

79-3105. Zakitis, L. H. (Bur. Trop. Dis., CDC, US Dep. HEW, Atlanta, GA 30333) **Extraction and gas-liquid chromatographic analysis of chlorphoxim in water and fish.** *Bull. Environ. Contam. Toxicol.* 23(3): 391-397; 1979 (10 references).

A method is presented in which the insecticide chlorphoxim is extracted from water and fish and analyzed by gas-liquid chromatography. Water samples were extracted with hexane. Fish samples were homogenized, shaken with acetone and extracted with hexane. Recovery from fortified fish samples ranged from 73 to 99%. Fish exposed to 0.02 ppm chlorphoxim for 24 hr had residues of 2.77-3.05 ppm. This method is fast and efficient, and is applicable to water and tissue analysis.

79-3106. Kostowska, B.; Piasecka-Grzeszek, A. (Dep. Ecol. & Weed Control, Inst. Plant Cultivat. Fertilizat. & Soil Sci., Wroclaw, Poland) **Oznaczanie pozostalosci benfluraliny i izopropaliny w lisciach tytoniu. [Determination of benfluralin and isopropalin residues in tobacco leaves.]** *Chem. Anal. (Warsaw)* 24(3): 481-485; 1979 (1 reference) (Polish).

Benfluralin and iospropalin were extracted from tobacco leaf samples with acetonitrile. The extracts were purified with hexane by liquid-liquid extraction and then eluted over an aluminim oxide column. Final detection was done by electron capture gas-liquid chromatography. Recoveries were in the range of 85% with sensitivities of 0.001 ppm for benfluralin and 0.002 ppm for isopropalin.

79-3107. Chmiel, Z. (Inst. Org. Ind., Pszczyna, Poland) **Spektrofotometryczne oznaczanie sladowych pozostalosci dwutiokarbaminianow w materiale roslinnym. [Spectrophotometric determination of trace residues of dithiocarbamates in plant material.]** *Chem. Anal. (Warsaw)* 24(3): 505-511; 1979 (11 references) (Polish).

The formation of methylene blue is used to spectrophotometrically determine the presence of dithiocarbamates in plant samples. Dithiocarbamate compounds are reduced to CS_2 with an acid solution containing stannous chloride. The reduced samples are then transferred by an air stream to a methanol washing solution containing potassium hydroxide. The xanthate is then pyrolyzed and hydrogen sulfide is obtained. In the presence of Fe^{3+} ions the hydrogen sulfide will react with *p*-amino dimethylaniline to form methylene blue. This method is one order of magnitude more sensitive than using diethanolamine and plant coloration interference is eliminated.

79-3108. Zembrodt, A. R.; Steer, F. J. (Drackett Co., Cincinnati, OH) **A liquid chromatographic determination of Baygon.** *Chem. Times Trends* 2(2): 48-50; 1979.

A liquid chromatographic technique which makes it possible to monitor Baygon (propoxur) levels during the development and production of pesticides was developed. Parameters are described for the analysis of Baygon after prior dissolution with methanol. Standards were made in the range of 2.5×10^{-4} to 7.5×10^{-4} moles Baygon/l in 5% methanol in chloroform. Ten μl of samples and standard were injected into the column, and the recorder was set at a speed of 0.5 inch/min. Two peaks were recorded at approximately 15 min. The peak areas were plotted against the concentration of the standards, and the area was then related to concentration. Baygon can be detected at levels of 0.06 μg or above. Isopropoxyphenol, the decomposition product of Baygon, can be detected at levels of 0.002 μg and above.

79-3109. Sandermann, H., Jr. (Inst. Biol. II, Biochim. Pflanzen, Univ. Freiburg, D-7800 Freiburg, BRD) **Triglyceride/phospholipid partitioning and persistence of environmental chemicals.** *Chemosphere* 8(8): 499-508; 1979 (21 references).

The solubility and partitioning of environmental chemicals in biological lipids (triolein and egg lecithin) was investigated. Five 100 mole samples of DDT, DDE, PCBs, 2,4-D, lindane, and dieldrin were dissolved in the lipids, followed by processing by isopycnic centrifugation. Solubilities of the pesticides were 1.5-5 times nigher in the triolein triglycerides than in egg lecithin. Partition coefficients for distribution between triolein and lecithin were 9.8, 9.0, 5.9, 3.2, and 2.7 for DDE, DDT, PCBs, dieldrin, and lindane, respectively. 2,4-D showed no detectable association with triolein. The affinity of these chemicals for triglycerides may account for their persistence in the environment.

79-3110. Smolkova, E., Jr.; Packakova, V.* (Dep. Anal. Chem., Fac. Natl. Sci., Charles Univ., CS-12840 Prague 2, Czechoslovakia) **Liquid chromatographic separation and behaviour of some substituted *s*-triazines on a CN-bonded stationary phase.** *Chromatographia* 11(12): 698-702; 1978 (24 references).

High performance liquid chromatography was used to study the behaviour of 19 *s*-triazine derivatives. The effect of the mobile phase on the separation of *s*-triazines was studied using the CN-bonded stationary phase. It was demonstrated that the CN-bonded stationary phase is used to advantage for separating *s*-triazines, in combination with both polar and non-polar stationary phases. Use of gradient elution seems helpful. Acidification of the polar mobile phase to a value of pH 3 can improve the separation of methoxy- and thiomethyl derivatives of *s*-triazines.

79-3111. Hotchkiss, J. H. (Oregon State Univ., Corvallis, OR) **Analysis of *N*-nitrosamines and nitramines in**

foods and herbicides. *Diss. Abstr. Int. B.* 40(2): 660-661; 1979.

A method to both estimate the volatile *N*-nitrosamine content of foods and to confirm the presence of volatile *N*-nitrosamines was developed. The identity of the *N*-nitrosamine was confirmed by combined gas chromatography and low resolution mass spectrometry. This work has demonstrated that low resolution mass spectrometry can be successfully utilized to confirm the identity of volatile *N*-nitroamines at 1 μg/kg in complex environmental samples such as foodstuffs. It was also demonstrated that at least five nitramines can elicit a false positive response from the thermal energy analyzer. Dipropylnitramine was responsible for a false positive response from an herbicide containing trifluralin, and butyl ethyl nitramine was responsible for a false positive peak from an herbicide containing benefin (benfluralin). The presence of dipropylnitrosamine and butyl ethyl nitrosamine in the herbicides, respectively, was also confirmed by both thermal energy analysis and mass spectrometry. It was shown that the thermal energy analyzer is subject to false positive responses from a group of compounds which are present in certain widely used herbicides and may be present in other environmental samples. These compounds may be misidentified as *N*-nitrosamines if mass spectrometry is not used to confirm the *N*-nitorsamine, or if only high resolution mass spectrometry of the *m/e* 30 ion is employed, as both types of compound are likely to contain this ion. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 7917870.)

79-3112. Franke, G.; Pietrulla, W.; Preussner, K. (Bundesgesundheitsamt, Max von Pettenkofer Inst., D-1000 Berlin 33, BRD) **Quantitative Bestimmung von Paraquat in Urin and Serum durch Differential Puls Polarographie. [Quantitative determination of paraquat in urine and serum by differential pulse polarography.]** *Fresenius Z. Anal. Chem.* 298(1): 38-42; 1979 (15 references) (German).

A sensitive and specific differential pulse polarographic method for the direct quantitative determination of paraquat (P) in ammoniacal ammonium chloride solution (pH 8), urine (pH 7) and serum (pH 6.5-8) is described. The peak potentials (E_p) in mV vs. saturated colomel electrode (SCE) were -686 mV for ammoniacal ammonium chloride solution, -679 mV urine, and -692 mV for serum. Analyses were performed in urine and serum both from persons poisoned with paraquat and from healthy persons. Urine and serum from the latter to which paraquat had been added served as control. The time needed for one complete analysis was 25 min. Detection limits were 0.03 μg P/ml for ammoniacal ammonium chloride solution, 0.05 μg P/ml for urine and 0.03 μg P/ml for serum. (Author abstract by permission)

79-3113. Varduca, A.; Luca, C.; Virtosu, D. (Inst. Plant Prot., Bucharest, Romania) **Detectia si estimarea compusilor organofosforici din apa. [Detection and estimation of organophosphorus compounds in water.]** *Hidrotehnica* 23(1): 11-13; 1978 (5 references) (Rumanian).

An enzymatic method for the determination of organophosphate pesticides in water is described. The method is based on measuring the inhibition of cholinesterase activity by the organophosphates *in vitro*. The method is sensitive, selective, and requires only 30 min. The detection limit is 0.001 μg for DDVP (dichlorvos), 0.005 μg for parathion, 0.020 μg for bromophos, 0.2 μg for malathion, 0.01 μg for carbaryl, and 1 μg for dipterex (trichlorfon).

79-3114. Steverink, A. T. G.; Steunenberg, H. (Spelderholt Inst. Poult. Res., Minist. Agric. & Fish., NL-7361 Beekbergen, The Netherlands) **Determination of chloramine-T in foodstuffs.** *J. Agric. Food Chem.* 27(5): 932-934; 1979 (10 references).

A gas chromatographic method for the quantitative determination of chloramine-T (C-T) in milk, ice cream, whole egg, mechanically deboned poultry meat, and croquettes has been developed. After hydrolysis of the C-T and precipitation and filtration of proteins and lipids, the hydrolysis product, *p*-toluene sulfonamide (*p*-TS), is extracted with ethyl acetate. Dried and concentrated extract is subjected to gas-liquid chromatography (column: 10% OV-7 on 100-120 mesh Gas Chrom Q), using a flame ionization detector. This method is capable of detecting 1 ppm of C-T and the average recovery is 80%. (Author abstract reprinted by permission of the American Chemical Society.)

79-3115. Ramsteiner, K. A.; Hoermann, W. D.* (Agric. Div., Ciba-Geigy Ltd., CH-4002 Basel, Switzerland) **High-pressure liquid chromatographic determination of hydroxy- *s*-triazine residues in plant material.** *J. Agric. Food Chem.* 27(5): 934-938; 1979 (21 references).

A specific method is described for quantitative determination of hydroxy- *s*-triazine residues in biological material. The hydroxy metabolites of atrazine, simazine, propazine, terbutylazine, and the corresponding methylthio and methoxy compounds are separated by high-pressure liquid chromatography on a silica gel column and detected at 240 nm with a UV spectrophotometer detector. The procedure involves the extraction of samples with methanol, cleanup with a strong cation-exchange resin, a polyacrylamide adsorption resin, and a styrene divinyl benzene gel filtration column. The clean-up procedure described is not suitable for dealkylated hydroxy- *s*-triazine metabolites; however, those compounds are separated chromatographically also under the liquid chromatographic conditions given. Recoveries in the range

of 70-113% indicated that this procedure is suitable to the residue analysis of hydroxy- *s*- triazines without derivatization of the metabolites with detection limits of 0.05 mg/kg. (Author abstract reprinted by permission of the American Chemical Society.)

79-3116. Day, E. W., Jr.; West, S. D.; Koenig, D. K.; Powers, F. L. (Agric. Anal. Chem., Lilly Res. Lab., Eli Lilly & Co., Greenfield, IN 46140) **Determination of volatile nitrosamine contaminants in formulated and technical products of dinitroaniline herbicides.** *J. Agric. Food Chem.* 27(5): 1081-1085; 1979 (12 references).

Routine methods for the measurement of volatile nitrosamines in several dinitroaniline herbicide products are described. Samples are dissolved in or extracted with an appropriate solvent and the nitrosamines are separated from the herbicides by alumina column chromatography. Eluate fractions containing nitrosamines are concentrated and the nitrosamines are measured using a gas chromatography thermal energy analyzer system. Nitrosamines can be readily determined at the 0.1 ppm level. (Author abstract reprinted by permission of the American Chemical Society.)

79-3117. Cabras, P.; Meloni, M.; Pirisi, F. M.* (Fac. Farm., Univ. Cagliari, I-09100 Cagliari, Italy) **Separation of insecticides by reversed-phase high-performance liquid chromatography.** *J. Chromatogr.* 176(3): 473-477; 1979 (15 references).

An HPLC method for the simultaneous quantitative determination of a mixture of chlorinated, carbamate and organophosphorus pesticides is presented. Dimethoate, carbaryl, tetrachlorvinphos and etrimphos in 200 fold concentrated grape extracts were eluted with distilled water and acetonitrile (50:50) plus 10% buffer. Analysis was performed at room temperature on a Perkin-Elmer liquid chromatograph with a variable wavelength UV detector. The column was a 25 x 0.26 cm ID reversed phase ODS-HC-Sil-X-1. The best wavelength for simultaneous determination was 221.0 nm. The lowest concentrations of the pesticides that could be simultaneously determined were 0.3 ppm for dimethoate, 0.002 for carbaryl, 0.2 for tetrachlorovinphos, and 0.2 for etrimphos. The sensitivity of the method is suitable for determining these pesticides at concentrations below those permitted in foodstuffs in Italy.

79-3118. Cook, C. E.; Ballentine, N. H.; Seltzman, T. B.; Tallent, C. R. (Chem. & Life Sci. Div., Res. Triangle Inst., Research Triangle Park, NC) **Warfarin enantiomer disposition: determination by sterioselective radioimmunoassay.** *J. Pharmacol. Exp. Ther.* 210(3): 391-398; 1979 (32 references).

The selective analysis of enantiomeric substances, without prior separation, by immunoassay techniques was investigated on *R*- and *S*-warfarin. The enantiomeric acids of the 4′- carboxyethyl analog of *R,S*-warfarin were coupled to bovine serum albumin (BSA). Rabbits immunized with these conjugates formed antisera which selectively bound to the predicted enantiomer. Of the various warfarin metabolites and their opposite enantiomers only 4′-hydroxywarfarin had a high cross-reaction. To determine the enantiomer half-lives in rats dosed with racemic warfarin, radioimmunoassys (RIA) were developed. The half-lives were estimated from linear regression analysis based on first order kinetics and the results obtained were consistent with those found previously by administration of the individual enantiomers. The authors suggest that antisera for both enantiomers of compounds to be analyzed by this method be developed to test the significance of the results.

79-3119. Kovacsne Huber, G.; Szalontai, G.; Pfeifer, G. (Heavy Metal Res. Inst., Veszprem, Hungary) **Enzimes es immunologiai modszerek alkalmazasa novenyvedoszermaradekok meghatarozasara. [Application of enzymatic and immunological methods to determine pesticide residues.]** *Magy. Kem. Lapja* 34(3): 127-130; 1979 (48 references) (Hungarian).

Enzymatic and immunological methods for the detection and determination of pesticide residues are reviewed. Good clean-up is essential for the enzymatic determination; mixtures of pesticide residues must be separated before the assay. In many cases, it is possible to detect and determine metabolites whose enzyme-inhibiting action is stronger than that of the starting compound. Immunological techniques, based on the use of antisera, can be used to detect DDT, DDA, and malathion in animals and plants. The enzymatic and immunological methods are highly sensitive, rapid, and can be automated.

79-3120. Everse, J.; Ginsburgh, C. L.; Kaplan, N. O. (Dep. Biochem., Sch. Med., Texas Tech. Univ., Lubbock, TX) **Immobilized enzymes in biochemical analysis.** *Methods Biochem. Anal.* 25: 135-201; 1979 (134 references).

Environmental applications of immobilized enzymes (IE) in biochemical analyses include the determination of pollutants or other toxic substances to which individuals are exposed in daily living. Cholinesterase is an enzyme which is particularly useful in this regard. In one technique employing this enzyme, the presence of small amounts of insecticides causes a significant drop in a fluorescence signal. The technique allows for rapid analysis of several samples in succession. A similar system is described which allows detection of pollutants in air and water. Methods which have been developed for the determination of metal ions or certain anions in water are briefly described. These methods can be used to determine the

concentration of fertilizers in soil. Examples of dichlorvos, parathion, demeton 0 and sarin are used to illustrate these methods. Also discussed are the preparation and properties of IE, different analytical assay methods using IE, and other detection applications using IE.

79-3121. Drevenkar, V.; Stipcevic, M.; Stengl, B.; Stefanac, Z. (Inst. Med. Res. & Occup. Health, Zabreb, Yugoslavia) **Gas chromatographic determination of alkali metal *O,O*- diethyl phosphorodithioate present in trace amounts.** *Mikrochim. Acta* 1(5-6): 385-394; 1979 (10 references).

A method using gas chromatography for the determination of trace amounts of alkali metal *O,O*- diethyl phosphoro dithioates calls for the conversion of the salts into a volatile derivative through alkylation with diazomethane. Gas chromatography coupled with mass spectrometry is used for compound identification. In the range of 0.04-1 ng of the compound in aqueous solutions a linear relationship of peak height to amount of salt was achieved. A calibration curve is presented for detection of trace amounts of the chemical in urine samples. The detection limit of the salt was 40 pg. Phosalone absorption was monitored in occupationally exposed persons using this technique.

79-3122. Roder, C. H.; Laass, H. (Zent. Anal. Pflanzenschutz & Galvanotech., Schering AG, Wolfenbuttel, BRD) **Beitrag zur Analytik der Phenoxyalkansauren. Teil 2. Analysenmethode zur Bestimmung von 2,4-D + MCPA, Mecoprop 2,4,5-T sowie 2,4-DP + 2,4,5-T in flussigen und festen Kombinationspreparaten. [Contribution to the analysis of phenoxyalkane acids. Part 2. Analysis methods for the determination of 2,4-D + MCPA, mecoprop + 2,4,5-T as well as 2,4-DP + 2,4,5-T in liquid and soil combination preparations.]** *Nachrichtenbl. Dtsch. Pflanzenschutzdienstes (Braunschweig)* 30(4): 55-60; 1978 (5 references) (German).

A method for the determination of 2,4-D + MCPA, mecoprop + 2,4,5-T, and 2,4-DP (dichlorprop) + 2,4,5-T mixtures in liquid and solid preparations is described. The method is based on the precipitation of the phenoxyalkanoic acids from their liquid and solid salt formulations, extraction, and the potentiometric titration of the total acid. The total acid is calculated on the basis of a pooled molecular weight determined from the surface percentage of a gas chromatogram. The respective pure acids are also determined gas chromatographically by transforming the total acid into the corresponding methyl esters with diazomethane, by calculating the percentage of the pure component in the gas chromatogram after separation from the isomeric impurities. The results obtained at 10 different laboratories showed good agreement.

79-3123. McElroy, F. C.; Searl, T. D.; Brown, R. A. (Anal. & Informat. Div., Exxon Res. & Eng. Co., Linden, NJ 07036) **Sample preparation for environmental trace organic analysis.** *NBS (US) Spec. Publ.* 519: 7-18; 1979 (20 references).

An overview of the methods for preconcentration of water and air samples is presented. The first step in sample preparation is preconcentration, either by sparging, adsorption on polymer resins, or liquid extraction. Sparging is the passing of an inert gas through a water sample, then passing the gas-organic mixture through an adsorptive material. The detection limit of organics is 0.5 μg/l. Some hydrocarbons have been detected at 0.01 μg/l by modifications of this method. Adsorptive traps used in sampling ambient air, stack gasses and wastewaters are Tenax GC and XAD-2. Some compounds have very low recoveries by this method; for example, phenol recovery is only 40%. Another method for analysis of phenols utilizes an anion exchange resin. Phenol can be recovered at 95% by this method as can several phenolic compounds. Methylene chloride solvent extraction has also been found to be efficient; 99% removal of polynuclear aromatic hydrocarbons (PNA) has been obtained using this chloride compound. Concentration by GC peak trapping techniques for separating very close peaks passing through a column are described. Resolution between overlapping peaks of 2-methyl phenanthrene, 1-methyl phenanthrene, and an alkylfluorene have been obtained. Methods of analysis of phenolics by ion exchange chromatogaphy and analysis of PNA by GC/UV peak trapping are described.

79-3124. Kurtz, D. A. (Pestic. Res. Lab., Pennsylvania State Univ., University Park, PA 16802) **Analysis of water for chlorinated hydrocarbon pesticides and PCB's by membrane filters.** *NBS (US) Spec. Publ.* 519: 19-32; 1979 (9 references).

Membrane filters made of cellulose triacetate material with a pore size of 0.45 μm have been shown to separate the pesticides from water. For ΣDDT, mirex, aldrin and PCB 98-99% removal from solutions has been observed. Recovery from the membranes has been 68-89% for DDT analogs, 97-113% for mirex, 89-112% for Aroclor 1242, and 83-84% for Aroclor 1254. The effect of pH on adsorptive quantities was determined. Three water samples were spiked with aldrin, *p,p'*-DDT and mirex. Percent recovery varied greatly, from 0% of mirex at pH 12 to 66% at pH 7. At pH 12, only 25% aldrin was recovered, while at pH 7, 90% was recovered. At pH 12, 97% *p,p'*-DDT was recovered, while at pH 10, 96% was recovered.

79-3125. Edwards, R. W.; Nonnemaker, K. A.; Cotter, R. L. (Waters Assoc. Inc., Milford, MA 01757) **The trace-level determination of organics by high-pressure liquid chromatography.** *NBS (US) Spec. Publ.* 519: 87-94; 1979 (1 reference).

The application of high pressure liquid chromatography (HPLC) to the analysis of organics is discussed. HPLC is a valuable analytical tool because extraction, derivatization and clean-up are not needed. Theoretical discussions of three applications are presented. First, the analysis of pentachlorophenol (PCP) in waste effluents is described. PCP at low ppb levels can be detected. The second application is a multi-residue determination of chlorphenoxy acid herbicides and carbamate, organophosphate and organochlorine insecticides in drinking water, requiring only minutes. Third, a single pesticide metabolite can be isolated from a soil sample containing many organics.

79-3126. Beggs D. (Hewlett-Packard Co., Palo Alto, CA 94304) **Automatic analysis of organic pollutants in water via GC/MS.** *NBS (US) Spec. Publ.* 519: 169-173; 1979 (3 references).

The use of automatic GC/MS for analysis of water samples is described. The procedures begin with a determination of which type of analysis, volatile organics, acid extract, base/neutral extract, or pesticides, is needed. The instrument automatically sets up the correct conditions for the necessary analysis. To aid in identifying unknowns, the mass spectrum of the tops of GC peaks are automatically compared with a library of stored spectra. All qualitative and quantitative data are printed out. To demonstrate the procedures San Francisco Bay water, an industrial effluent and drinking water were analyzed. Retention times and concentrations of the compounds in the samples are printed out, as is a profile of the volatile organics. Levels as low as 1.0 ppb of toluene and chlorobenzene were found in the bay water. Concentrations of 0.06 ppb 1,1-dichlorothane were found in industrial effluent.

79-3127. Mindrup, R., Jr. (Supelco Inc., Bellefonte, PA 16823) **New column technology in the analysis of organics in water by gas chromatography.** *NBS (US) Spec. Publ.* 519: 225-229; 1979 (1 reference).

As part of the Safe Drinking Water Act, new procedures for concentrating compounds in the sub-ppb range were developed. Four classifications of organics were created based on the method for concentration. Volatile organics were purged from samples with helium gas, then collected on a 6' x 1/8'' SS column with Carbowax C modified with 0.2% carbowax 1500 80/100 mesh. Base neutrals were analyzed by treating water samples with 6*N* NaOH to an adjusted pH of 11 and extracted with methylene chloride. The extract was analyzed on a 1% SP-2250 on 100/120 Supelcoport column. Acidic compounds, consisting of 11 subsituted phenols, were acidified with 6*N* HCl to a pH of 2, then samples were extracted with methylene chloride. An SP-1240 DA column gave complete resolution of the 11 compounds. A Tenax column was not nearly as good. Pesticides and PCBs were extracted from water with 15% methylene chloride in hexane and run through a 1% SP-2250 on 100/120 Supelcoport.

79-3128. Horwitz, W.; Howard, J. W. (Bur. Foods, US FDA, Washington, DC 20204) **Sampling methods for trace organic analysis in foods.** *NBS (US) Spec. Publ.* 519: 231-242; 1979 (17 references).

The objectives and important areas of analytical food chemistry are presented with emphasis on sampling and its impact on food analysis. The most common objectives are to determine safety, to ascertain if the product meets legal, nutritional or commercial specifications, and to specify the quality and value of the product. The purpose of the sample will determine the nature of the sampling procedure; therefore, the purpose of the sample must be defined. Problems of food chemistry at the μg and mg/kg levels often involve heterogeneous distribution of toxic compounds. Thus, the sampling error is greater than the analytical error. Describing specific examples of analyses for pesticides, aflatoxins and nitrosamines, the authors provide important points regarding sampling. Considerations of the results of lab samples are not as important as the implications about the lot they represent. Greater reliability is achieved only by examining more and/or larger samples.

79-3129. Schmeltz, I.; Brunnemann, K. D.; Hoffmann, D. (Div. Environ. Carcinog., Naylor Dana Inst. Dis. Prev., American Health Fnd., Valhalla, NY 10595) **Trace analysis in agricultural products. Methods for hydrazines, carbamates, *N*-nitrosodiethanolamine and other compounds.** *NBS (US) Spec. Publ.* 519: 297-309; 1979 (34 references).

Crops are often analyzed for trace quantities of toxic degradation products of growth regulators, herbicides and insecticides. Hydrazines in tobacco are detected by passing smoke through water with pentafluorobenzaldehyde, or an aqueous extract of the tobacco is reacted with the aldehyde. Gas chromatography following thin layer chromatography results in 1,1-dimethyl hydrazine detection. Methyl or ethylcarbamates are detected by gas chromatogaphy and confirmed by mass spectroscopy.

79-3130. Mady, N.; Smith, D.; Smith, J.; Wezwick, C. (Chem. Res. Cent., Allied Chem. Corp., Morristown, NJ 07960) **Analysis of Kepone in biological samples.** *NBS (US) Spec. Publ.* 519: 341-343; 1979 (4 references).

A simple, rapid method for the analysis of Kepone (chlordecone) in biological samples is described. A 10 g sample of bluefish or shrimp, with Kepone added, was placed into a flask containing 50 ml ethyl ether. After homogenization 5 g of $MgSO_4$ was added. After the slurry was filtered the filtrate was evaporated to 5 ml and passed through a Florisil PR column with 50 ml n-hexane and

discarded. Kepone was then eluted with 40 ml toluene and methanol. Gas chromatography was used to analyze the eluate. Recoveries of Kepone were 80-105%. The use of methanol as well as changes in the solvent composition can alter the response as much as 100%. Also, the ether used in extraction must be ethanol-free. Concentrations of 10 ppb may be determined without further concentration of the eluate. If eluates are concentrated further, levels of less than 1 ppb may be detected.

79-3131. Getz, M. E.; Hanes, G. W.; Hill, K. R. (Agric. Environ. Qual. Inst., ARS, USDA, Beltsville, MD 20705) **Progress in the automation of extraction and cleanup procedures for detecting trace amounts of pesticides in environmental samples.** *NBS (US) Spec. Publ.* 519: 345-353; 1979 (5 references).

Because of the large numbers of tests on food or environmental samples that are run to determine concentrations of pesticides, automation in analysis is being developed. This paper presents a system in which modules were assembled to automatically index, blend, extract, pump, partition, concentrate and clean-up the sample. Analyses were run, using these modules, on samples of vegetable, animal and mineral materials fortified with 1 μg/g malathion, diazinon, methyl parathion, carbaryl and carbofuran. The liquid effluent was collected and analyzed by gas chromatography or by wire-transport chlorine, phosphorus or nitrogen element selective detectors. Preliminary work shows that the concept of automating the extraction and clean-up of samples is practical.

79-3132. McNair, H. M. (Dep. Chem., Virginia Polytech. Inst., Blacksburg, VA 24061) **Analytical systems for trace organic analysis.** *NBS (US) Spec. Publ.* 519: 541-546; 1979 (2 references).

A review of the various methods for determining trace levels of organic compounds is presented. Systems are ranked according to the detection, necessary sample state and size, detector response and instrument availability. The best system is thought to be mass spectrometry coupled with gas chromatography. Next, the author feels, is gas chromatography alone, followed by liquid chromatography, then atomic absorption/ atomic fluorescence, nuclear magnetic resonance, then miscellaneous methods: fluorescence radiochemical/RIA, electrochemical, plasma induced emission spectroscopy and biological assays. The advantages and limitations are presented.

79-3133. Ettre, L. S. (Perkin-Elmer Corp., Norwalk, CT 06856) **Selective detection in chromatographic analysis.** *NBS (US) Spec. Publ.* 519: 547-585; 1979 (120 references).

A review of selective detection in chromatography is presented. This method was devised as a solution to the problem of identifying the ppb levels of compounds that can often be detected by chromatographic techniques. Detectors which respond to specific compounds, selective detection, are suggested to be the best solution. The original detectors which were selective for halogenated pesticides were electron capture and colorimetry. Newer models for the selective detection of phosphorous, sulfur and nitrogen compounds are now availabale. Some of the newest models include IR and UV spectroscopy. Liquid chromatography variable wavelength UV detectors may prove to be more sensitive and selective than gas chromatography detectors.

79-3134. Scott, R. P. W. (Hoffman-LaRoche Inc., Nutley, NJ 07110) **The wire transport LC/MS system.** *NBS (US) Spec. Publ.* 519: 637-645; 1979 (6 references).

Because of the problems in analyzing involatile compounds which do not lend themselves to gas chromatography, liquid chromatography interfaced with mass spectrometry has been developed. A refinement of this methodology is the wire transport system which carries the sample, continuously from the LC to the MS. Two types of interface incorporating the wire transport concept are described. The first is a wire pulled from one spool to another. The second type utilizes a continuous ribbon which can sample a far greater quantity of column eluent and consequently carry more solute into the MS. The systems presently available have low sensitivity. They can be improved by the use of an alternative vaporizing procedure by heating the wire or ribbon with infrared or by laser light. Applications of the system to drug, vitamin and pesticide analysis are given.

79-3135. Carroll, D. I.; Dzidic, I.; Stillwell, R. N.; Horning, E. C. (Inst. Lipid Res., Baylor Coll. Med., Houston, TX 77030) **Atmospheric pressure ionization mass spectrometry.** *NBS (US) Spec. Publ.* 519: 655-671; 1979 (11 references).

Atmospheric pressure ionization mass spectrometry is discussed and examples of the analytical procedures are provided. Differences in this method and conventional MS are illustrated. Sample ionization occurs in a small chamber at atmospheric pressure. Detection includes both negative and positive ions with a source which does not contain a heated filament. Direct injection or input from a gas chromatograph are both possible. Positive and negative ions at > pg levels, and both long and short-lived types can be detected. Methyl parathion was used as a test chemical for these analyses.

79-3136. Ramos, L. S.; Brown, D. W.; Jenkins, R. G.; MacLeod, W. D. (Natl. Anal. Fac., Environ. Conserv.

Div., NOAA, Seattle, WA 98112) **Modification of conventional gas chromatographic inlets for the use of glass capillary columns.** *NBS (US) Spec. Publ.* 519: 713-718; 1979 (8 references).

Hewlett-Packard 5840A and Finnigan 9500 gas chromatographs were used to develop a new inlet design. The injection port at the septum was approximately 5 mm id. A 1/16" steel tube was soldered into a 1/4 to 1/16" reducer. A reducer was placed on the detector inlet to allow the insertion of the end of the capillary column into the detector. Routine temperature programming is used, with either a manual or automatic sample injection configuration. Samples with up to 33 very diverse compounds were analyzed with excellent results. This modification is economic, simple, and has wide applicability. A minimum of dead volume permits operation in either split or splitless injection modes. The glass insert can be removed easily, and the position of the column in the injector can be adjusted relative to the point of vaporization for optimal transfer. Although most of the analyses have been performed on aliphatic and aromatic hydrocarbons, samples of polar compounds and pesticides have been examined with equally excellent results.

79-3137. Lupton, J. D.; Havlicek, S. C.; Loy, P. R. (Eng. Exp. Stn., Georgia Inst. Technol., Atlanta, GA 30332) **The use of a novel gas chromatographic detection system for the analysis of trace halo-organics.** *NBS (US) Spec. Publ.* 519: 777-782; 1979 (4 references).

A new electron capture gas chromatograph detector with a porous anode open cell design is described. This detector has the advantage of having the point of detection at a higher pressure than the gases leaving the detection chamber, thus there is a decreased opportunity for sample molecules to reenter the zone of detection, or recirculate. Impure samples can be used at low flows. Selectivity, linearity of response and extreme sensitivity are other features of standard detectors which are also found in this new type. The detector can return to baseline very rapidly, within 2 min. This is useful when detecting lindane by chloroform extraction followed by direct injection into the gas chromatograph. The analysis of sludge heavily contaminated with pesticides is another practical application of this detector. The only pretreatment required is drying over anhydrous sodium sulfate.

79-3138. Nagayoshi, H.; Saito, N.; Suzuki, K. (Agric. Chem. Insp. Stn., Minist. Agric. Forest. & Fish., Kodaira, Tokyo, Japan) **[Application of a systematic method for identification and determination of pesticides to multiresidue analysis. Organophosphorus pesticides.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 4(2): 209-213; 1979 (9 references) (Japanese).

Application of a systematic method for identification and determination of pesticides using column-chromatography, thin-layer chromatography and gas-chromatography was carried out on organophosphorus pesticides (Groups 2-6). Artificially fortified sweet corn specimens were made at two levels, 0.5-5.0 ppm and 0.05-1.0 ppm. The recovery of each pesticide from the fortified corn was almost 80%. Actual values were 79-85% for disulfoton, 90% for salithion, 93-95% for phosalone, 90-110% for tetrachlorvinphos, 66-25% for fenthion, 75-97% for ethion and 89-100% for malathion. The lower figure given is for the higher level of fortification and vice versa.

79-3139. Goto, S. (Inst. Environ. Toxicol., Kodaira, Tokyo, Japan) **[Analytical methods of pesticide residues based on the notification of environmental agency. Part 3.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 4(2): 219-225; 1979 (2 references) (Japanese).

An outline of the methods used to determine residues of the pesticides designated for review by the Japanese Environmental Agency in 1977, 1978 is given. The pesticides considered are organophosphate, organochlorine and carbamate insecticides.

79-3140. Goto, S. (Inst. Environ. Toxicol., Kadaira, Tokyo, Japan) **[Studies on spectrophotometric determination of pesticides.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 4(2): 239-246; 1979 (37 references) (Japanese).

The methods for determination of pesticides using spectrophotometry (SP) are described. Dinitrocyclohexylphenol, fenitrothion and pentachlorophenol (PCP) are determined by absorption SP (ASP), cellocidin and dithianone by UV ASP, and mecarbam and chlorthimaide by a combination of TCL and ASP. Pesticides containing a nitro group can be resolved by a combination of diazotiazation and ASP. Infrared spectrophotometry of technical aldrin, tetradifon, heptachlor, naled and trichlorfon is described. Colorimetry is used for the detection of parathion, nitrofen, quintozene, and chloraniline herbicides. Residue analysis of naphthalene, carbaryl, benomyl, thiophanate-methyl and naproanilide by high speed liquid chromatography equipped with a fluorophotometer is also discussed.

79-3141. Mingelgrin, U.; Kliger, L.; Saltzman, S. (Div. Soil Residues Chem., Inst. Soils & Water, Agric. Res. Org, Bet Dagan, Israel) **Determination of the products of surface-induced hydrolysis of organophosphours pesticides.** *Pestic. Sci.* 10(2): 133-138; 1979 (6 references).

A procedure which enables the identification of the hydrolysis products of a number of phosphoric and phosphorothioic esters was developed. This procedure, which includes thin-layer chromatography (TLC), gas chromatography and UV spectroscopy, has been used to demonstrate that surface hydrolysis on kaolinite is a

general property of bioactive phosphoric and phosphorothioic esters. The path of hydrolysis was shown to be the breakage of the P-OA or P-SA bond, where A is the electron attracting moiety of the organic molecule. (Author abstract by permision)

79-3142. Houx, N. W. H.; Jongen, W. M. F.; de Vries, A. W.; Welling, W.; Dekker, A. (Lab. Res. Insectic., NL-6709 Wageningen, The Netherlands) **Analysis of polar metabolites of organophosphorus insecticides on an anion-exchange chromatographic column.** *Pestic. Sci.* 10(3): 185-200; 1979 (24 references).

A simple and rapid procedure is described for the qualitative and quantitative analysis of metabolites of malathion and other insecticides. The omission of an extraction at low pH, and mild conditions of anion-exchange chromatography on QAE-Sephadex prevent the degradation of a malathion metabolite, *S*- (1-carboxy- 2-ethoxycarbonyl)- ethyl *O,O*- dimethyl phosphorothioate (malaoxon α- carboxylic acid), which takes place under strongly acidic conditions. Disadvantages of the commonly used fractionation of malathion and malaoxon metabolites based on partitioning are discussed. (Author abstract by permission)

79-3143. Zadrozinska, J. (Inst. Hyg., P-00791 Warsaw, Poland) **Zastosowanie grzybow jako testu biologicznego do oznaczen pozostalosci niektorych fungicydow w materiale roslinnym. I. Oznczczanie benomylu, tiofanatu metylu, karbendazymu i tiabendazolu w owocach cytrusowych i bananach. [Application of fungi as a biological test for determining the residues of certain fungicides in plant material. I. Determination of benomyl, methyl thiophanate, carbendazyme and thiabendazol in lemon oranges, grapefruits, and bananas.]** *Rocz. Panstw. Zakl. Hig.* 30(1): 31-37; 1979 (17 references) (Polish).

Pencillium cyclopium cultures were maintained in petri dishes with silica gel. Fruit extracts were applied to the cultures. *P. cyclopium* inhibition was observed as a means to determine the residues of benomyl, thiophanate-methyl, carbendazyme and thiabendazol present. Thin layer chromatography was performed to the test the reliability of the results. Depending on the fruit species, benomyl and carbendazyme could be detected at levels of 0.01-0.02 mg/kg, thiophanate-methyl at 0.025-0.050 and thiabendazol at 0.05-1.00 mg/kg.

79-3144. Gorski, T.; Syrowatka, T. (Dep. Toxicol., Inst. Public Health & Hyg., Warsaw, Poland) **Uproszczona metoda rozdzialu i oznaczania pozostalosci pestycydow chloroorganicznych i polichlorowanych dwufenyl w tkance tluszczowej czlowieka. [A simplified method of separation and determination of residues of organochlorine pesticides and polychlorinated diphenyls in human fatty tissue.]** *Rocz. Panstw. Zakl. Hig.* 30(1): 57-65; 1979 (11 references) (Polish).

A Varian 1400 gas chromatograph with electron capture detection (GC-ECD) was used to separate DDT and its derivatives, hexachlorobenzene, and BHC from PCB residues in human adipose tissue. The pesticides were removed from the samples with hydrochlorides and oxidized to prevent interference with the PCB determinations. A 30 x 2.3 cm column at a temperature of 200°C was used. The N_2 gas flow rate was 40 cm^3/min. The detection limit for PCB in the tissues was 0.01 mg/kg. The method may be used for routine determinations.

79-3145. Cwiertniewska, E.; Potrzebnicka, K. (Inst. Anal. Agric. Commod. & Objects Use, State Inst. Hyg., P-00791 Warsaw, Poland) **Oznaczanie pozostalosci endosulfanu w truskawkach i malinach. [Determination of endosulfan residues in strawberries and raspberries.]** *Rocz. Panstw. Zakl. Hig.* 30(3): 261-265; 1979 (20 references) (Polish).

A method for the determination of residues of the α and β isomers of endosulfan as well as of endosulfan sulfate in strawberries and raspberries is described. Gas chromatography using a Pyre-Unicam unit with electron capture detector was applied. The column filling was 10% DC-200 on Chromosorb W 100-120 mesh, the column temperature was 225°C, the detector temperature 280°C, and argon was used as a carrier gas at a flow rate of 100 ml/min. At levels of 0.002 mg/kg of the α isomer and sulfate and 0.02 mg/kg of the β isomer in strawberries and respberries, the average recovery rates were 81.5% and 82% for the α isomer, 66.6% and 63.1% for the β isomer, and 84.7% and 101% for endosulfan sulfate, respectively. The detection limits were 0.0002 mg/kg for the α isomer, 0.4420 mg/kg for the β isomer, and 0.0001 mg/kg for endosulfan sulfate. In some marketed samples, trace amounts of the α isomer and sulfate were found: the mean values found in respberries were 0.0009 and 0.0005 mg/kg, respectively, and those found in strawberries were 0.0008 and 0.0005 mg/kg, respectively.

79-3146. Nawrot, P. S.; Howell, W. E.; Wenger, B. S. (Environ. Biol. & Chem. Branch, NIEHS, Research Triangle Park, NC 27709) **Biochemical and electrophorectic studies of cholinesterases in the muscular dysgenesis (*mdg*) mutant mouse.** *Teratology* 20(1): 7-16; 1979 (50 references).

Acetyl- and butyryl- cholinesterase activities were investigated in muscle, brain, blood plasma and erythrocyte membranes obtained from adult and fetal mice of different genotypes with respect to the muscular dysgenesis (*mdg*) gene. Samples of the same tissues were subjected to zone electrophoresis, for investigating patterns of cholinesterase isozymes, non-specific esterases and total

protein. Two distinct bands and a faster moving series of poorly resolved bands of acetylcholinesterase were found in muscle and brain of phenotypically normal fetuses. One of the main bands and the diffuse bands were absent in muscle and the diffuse bands were reduced in brain of homozygous (*mdg/mdg*) mutant fetuses. Except for increased Coomassie blue staining of a few bands in muscle, gels stained for AChE in other tissues, for BuChE, for alpha naphthyl esterase and for total protein showed no differences between mutant and control fetuses. No differences in any electrophoretic patterns were detected between heterozygous (*+/mdg*) and homozygous wild type adults. (Author abstract by permission, abridged)

79-3147. Luster, M. I.; Albro, P. W.; Clark, G.; Chae, K.; Chaudhary, S. K.; Lawson, L. D.; Corbett, J. T.; McKinney, J. D. (Environ. Biol. & Chem. Branch, NIEHS, Research Triangle Park, NC 27709) **Production and characterization of antisera specific for chlorinated biphenyl species: initiation of a radioimmunoassay for Aroclors.** *Toxicol. Appl. Pharmacol.* 50(1): 147-155; 1979 (16 references).

Antisera to 4-amino-4′- monochlorobiphenyl, 2-amino- 4,5,3′,4′-, and 3- amino- 2,6,2′,6′-tetrachlorobiphenyl have been produced in rabbits by conjugating these compounds to proteins using the mixed anhydride method. Extensive characterization studies indicated the antisera were fairly specific to their nonaminated biphenyl analogs. Values for these isomers in Aroclors by radioimmunoassay and gas chromatography correlated well for several of the antisera. Suggestive evidence is presented indicating the feasibility of employing radioimmunoassays for determining the Aroclor product number and concentration in environmental samples. A feature of the assay is the use of nonionic detergents to solubilize the extremely hydrophobic chlorinated biphenyls in a manner permitting their binding to antibodies. Furthermore, this approach should minimize some of the problems due to interfering substances such as DDE, DDT, and polychlorinated terphenyls in conventional gas chromatographic analysis. (Author abstract by permission)

79-3148. Thompson, J. F., ed.; Watts, R. R., ed. (Anal. Chem. Branch, Environ. Toxicol. Div., Health Eff. Res. Lab., Research Triangle Park, NC 27711) **Analytical reference standards and supplemental data for pesticides and other organic compounds.** *US Ntis PB Rep.* PB-284224: 114 pg.; 1978.

This material lists several hundred compounds of analytical reference standards of insecticides, herbicides, algicides, nematocides, rodenticides, fungicides, and miscellaneous organic compounds which are available mostly in purified form in subsamples of 50-100 mg to any non-profit laboratory in the world free of charge. Also included in the manual are miscellaneous data pertinent to pesticidal compounds such as precautionary notes in the handling and storage of highly toxic compounds, the preparation and storage of solutions of standards, residue methodology references, and an index of over 3,500 pesticide equivalent names. (Author abstract by permission)

79-3149. Warner, J. A. S.; Bearse, A. E.; Wyant, R. E.; Clarke, P. A. (Battelle Columbus. Lab., Columbus, OH 43201) **Identification of toxic impurities in technical grades of pesticides designated as substitute chemicals.** *US NTIS PB Rep.* PB-282245: 400 pg.; 1978.

Two different approaches were used to identify potentially harmful impurities present in technical grade pesticides. One approach was a theoretical approach that involved a literature search, study the manufacturing processes, identifying the main reactions and the numerous side reactions that may occur, listing the potential impurities that may result, and estimating the likelihood of the occurrence of such impurities at μg/g or lower levels in the final product. The second approach was experiment and involved the use of combined gas chromatography mass spectrometry (GC-MS) to identify and quantify the major impurities actually present in technical-grade materials. In addition to the above two tasks the program also include maintaining and assaying a repository of selected technical-grade pesticides. (Author abstract by permission)

79-3150. O'Brien, M. C.; Prendeville, G. N. (Bot. Dep., Univ. Coll., Cork, Ireland) **A rapid sensitive bioassay for determination of paraquat and diquat in water.** *Weed Res.* 18(5): 301-303; 1978 (11 references).

The change in cell-membrane permeability as indicated by leakage of electrolytes from treated fronds of *Lemna minor* was the criterion used to detect the presence of diquat and paraquat in solution. The minimum herbicide concentrations that could be detected ranged from 1.8 to 1.7 μg/ml, diquat and paraquat cation respectively after 3 hr treatment, to 0.00018 and 0.000017 μg/ml after 72 hr. Paraquat was more active than diquat in all treatments. Increase in cell membrane permeability occurred without the appearance of injury such as chlorosis or bleaching of fronds. Light was necessary for these herbicides to alter cell membrane permeability though a little herbicidal activity could be detected after 48 hr in the dark at concentrations above 0.17 μg/ml. (Author abstract by permission)

See also **79-2856, 79-2857, 79-2893, 79-2899** *and* **79-2914.**

★ U. S. GOVERNMENT PRINTING OFFICE : 1980—620-372/7

United States
Environmental Protection
Agency

Official Business
Penalty for Private Use
$300

TS-793: Rm: E-447

Washington DC 20460

Fourth-Class Mail
Postage and Fees Paid
EPA
Permit No. G-35

3ERAPP80 00001 001567875 001 001
UNIV MICROFILMS INTL
SERIALS PROCESSING DEPT
300 N ZEEB RD
ANN ARBOR MI 48106